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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	April 30 Tons	May 31 Tons	June 30 Tons
In England	21,764	20,524	19,233
In France	3,223	3,380	2,859
Afloat from Chile	2,050	1,700	1,350
Afloat from Australia	3,400	4,000	4,700
In Rotterdam	6,200	4,800	4,700
In Hamburg	4,920	3,822	3,441
In Bremen	2,271	1,961	1,913
In other European Ports.....	2,000	1,500	1,300
Total European visible supply	45,828	41,687	39,496

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Produc- tion.	Deliveries			Stocks at end of month
		Domestic	Foreign	Total	
Total, 1911.....	639,258	316,791	337,009	653,800	—
Total, 1912.....	706,052	365,920	333,212	699,132	—
January	64,053	29,111	26,956	56,067	55,000
February	58,460	26,641	32,219	58,860	54,600
March	60,822	34,190	34,682	68,872	46,550
April	60,416	34,892	38,346	73,238	33,728
May	63,088	36,209	30,477	66,686	30,130
June	54,402	30,559	30,396	60,955	23,577

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand		Else- where	Total	Value
	Oz.	Oz.	Oz.	£	
Year 1912	8,753,563	370,731	9,124,299	38,757,560	
January 1913	760,981	28,409	789,390	3,353,116	
February	702,394	31,728	734,122	3,118,352	
March	760,324	30,228	790,552	3,358,050	
April	755,858	29,116	784,974	3,334,358	
May	761,349	32,957	794,306	3,373,998	
June	716,267	30,810	747,077	3,173,382	

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
July 1912.....	2,149,785	28 6	18 8	9 11	1,061,089
August	2,121,455	28 9	18 10	10 0	1,055,315
September	2,081,295	28 7	18 8	10 0	1,040,820
October	2,200,709	28 0	18 3	9 10	1,079,334
November	2,155,690	28 2	18 5	9 10	1,059,564
December	2,218,305	28 0	18 0	10 3	1,129,372
January 1913.....	2,296,948	27 8	18 0	9 9	1,113,579
February	2,100,137	27 11	18 3	9 9	1,019,774
March	2,321,254	27 5	17 8	9 8	1,121,786
April	2,301,099	27 6	17 11	9 7	1,101,099
May	2,366,726	26 11	17 7	9 4	1,099,397

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
April 30, 1912.....	197,137	8,364	13,785	220,086
May 31	193,829	8,460	14,538	216,827
June 30	188,494	8,549	15,330	212,373
July 30	182,925	8,497	15,834	207,256
August 31.....	179,111	8,766	15,934	203,811
September 30.....	180,739	8,783	15,752	205,274
October 31	182,058	8,803	15,496	206,357
November 30	186,881	8,767	14,872	210,520
December 31	191,316	8,634	14,965	214,915
January 31, 1913.....	200,090	8,789	13,912	222,791
February 28.....	207,662	8,877	13,918	230,457
March 31	207,733	9,009	15,041	231,783
April 30	205,424	9,053	15,626	230,103
May 31	197,644	9,062	15,345	222,051
June 30	188,094	9,060	14,654	211,808

GOLD OUTPUT OF INDIA.

Year 1911	Year 1912	June 1913	Year 1913
£2,150,050	£2,265,094	£189,322	£1,130,965

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1909	1910	1912	1913
	£	£	£	£
January.....	204,666	227,511	214,918	220,776
February	192,497	203,888	209,744	208,744
March	202,157	228,385	215,102	237,797
April	222,700	228,213	221,476	241,098
May.....	225,032	224,888	234,407	242,452
June	217,600	214,709	228,867	—
July.....	225,234	195,233	240,514	—
August	228,296	191,423	239,077	—
September	213,249	178,950	230,573	—
October	222,653	234,928	230,072	—
November.....	236,307	240,573	225,957	—
December.....	233,397	199,500	218,661	—
Totals.....	2,623,788	2,568,201	2,707,368	1,170,867

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
January	15,903	£66,107	26,098	£107,262	34,857	£144,262
February	15,179	£63,081	25,009	£102,270	32,544	£137,038
March	16,387	£67,673	27,228	£111,376	36,289	£150,660
April	17,237	£70,880	27,790	£114,796	35,295	£146,220
May	24,427	£96,409	28,015	£115,675	34,507	£142,617
June	22,555	£92,174	27,784	£114,697	—	—
July	22,510	£91,955	30,974	£127,800	—	—
August.....	25,385	£103,753	33,015	£136,407	—	—
September.....	26,717	£109,039	34,491	£142,397	—	—
October	26,826	£109,503	34,436	£142,414	—	—
November.....	24,289	£99,299	33,183	£137,700	—	—
December	24,369	£99,569	34,917	£144,382	—	—
	261,784	1,069,442	362,940	1,497,179	173,492	720,197

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
Total, 1911	160,021	1,210,447	1,370,468	5,823,522
Total, 1912	83,589	1,199,080	1,282,669	5,449,057
January 1913	9,738	94,967	104,705	444,756
February	8,780	92,207	100,987	428,963
March	754	97,015	97,769	415,294
April	7,920	103,324	111,244	472,532
May.....	7,094	103,085	110,179	468,007
June	5,112	108,373	113,485	482,050

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	June 1913	1913 to date
Victoria	2,138,000	£2,039,400	£187,300	903,500
Queensland	1,623,390	1,484,160	83,250	557,150
New South Wales	769,353	702,129	52,424	298,151
New Zealand	1,808,049	1,345,115	73,217	672,294

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911	6151½	£702,599	£114 4 5
Year 1912	6492	£831,908	£128 5 6
January 6, 1913	231	£32,769	£141 17 2
January 20,	257½	£36,647	£142 9 1
February 3,	2602	£36,221	£138 18 3
February 17,	236	£32,393	£137 5 2
March 3,	252½	£33,251	£131 13 9
March 17,	229	£29,302	£127 19 2
March 31,	258	£34,256	£132 15 6
April 14	217½	£30,512	£140 2 6
April 28	262	£36,327	£138 13 1
May 13.....	224	£31,315	£139 16 0
May 26.....	259½	£34,296	£132 3 3
June 9.....	207	£25,846	£124 17 3
June 23.....	232½	£26,072	£112 5 2

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1912 tons	June 1913 tons	1913 tons
Metal from Straits to Europe and America	59,036	4,822	30,764
Metallic Content from Bolivia to Europe.....	21,149	3,299	12,603

REVIEW OF MINING

INTRODUCTORY.—The stability of the mining market has been extraordinary considering the continued shocks to which it has been subjected. A prediction of simultaneous war in the Balkans, anarchy in Mexico, and labour disorders on the Rand would usually evoke visions of a financial cataclysm. But depression has prevailed so long that business is at the lowest ebb, open accounts are small and few, and weak spots have been relieved by liquidation long ago. Consols fell to 72½ on July 5, this being the lowest record since the early part of the last century. Other gilt-edged securities have wilted, owing not only to the necessity for strengthening financial fences, but by reason of the issuance of new bonds, such as those of China and Mexico, at a much higher rate of interest. On top of these untoward developments there loomed, for a few days, the fear that the gold production of the Transvaal would be stopped, and that 40% of the world's current supply of the basic metal would cease abruptly. How much the regulation of prices and the foundation of credit depends upon the supply of gold, nobody knows; but everybody fears to see so vast an experiment tried, and the mere threat of it would undermine worldwide commerce.

TRANSVAAL.—The yield of gold for June suffered, of course, from the strike. It was 747,077 oz. valued at £3,173,382. The supply of native labour showed a decrease of 9550; this being due partly to the seasonal migration and partly to the disruption caused by the strike of white workers.

Whatever the general result of the strike, it is certain that some mines operating on the ragged edge of profit will never resume operations. This is true already of the Vogelstruis, Treasury, and Jumpers.

The directors of Knight's Deep have de-

cided to retain the Simmer & Jack East and to increase the capital in order to repay the Gold Fields loan.

Before the New Kleinfontein became, unfortunately, prominent as the mine where the recent strike began, it achieved notoriety by reason of a dispute concerning the length of its 'life,' that is, the time it could continue to be productive. An engineer not connected with the company, but representing an outside firm, estimated the life at 8½ years, as against the reduced official estimate of 13 years.

Owing to the serious state of affairs on the Rand, Sir George Albu is returning forthwith to Johannesburg. As a man highly respected, especially in the engineering profession, the chairman of the General Mining group will undoubtedly afford invaluable aid in straightening difficulties.

The report of Mr. Robert Pill indicates that the Cinderella Consolidated cannot maintain its output. This is due mainly to faulting, which has hindered the development of fresh stoping ground. High standing charges and deeper mining are stated as the reasons for the increase in the cost of operating this mine. Therefore, milling will be suspended pending further development underground.

The President of the Chamber of Mines acknowledges the justice of the Union Government's decision not to permit the further importation of natives from tropical areas. It is well that the question of mortality among natives on the Rand should be studied for economic as well as humane reasons.

On June 16 the Minister for Mines, Mr. F. Malan, announced to the Union Parliament that "remarkable progress" had been made in combating phthisis among the miners on the Rand, the result being due to the copious use of water when drilling and blasting.

The recent developments at Luipaard's Vlei in the far west Rand, under the management of Mr. C. B. Saner, have been sufficiently encouraging to warrant an increase in the output from 16,500 to 21,500 tons per month. In order to treat the additional amount of ore, two tube-mills are being erected. The crushing plant will then consist of 60 stamps and 5 tube-mills. The orebodies are irregular and of low grade, and their profitable exploitation has been difficult.

The Montrose Diamond Co. issues a circular, stating that Mr. Percy Marsden, a large shareholder, has recently visited the mine, and reports most favourably on the progress of operations. He arranged for an inspection by representatives of Lewis & Marks, which firm will now undertake the general management of the property.

RHODESIA.—The production of gold in May calls for no special comment. A total of 57,866 ounces, worth £242,452, is satisfactory as compared with £234,407 in the corresponding month last year. The Chamber of Mines also reports the output of silver, lead, coal, chrome, and diamonds. These are interesting as suggesting that Rhodesia produces other minerals and metals besides gold.

Sir Starr Jameson has been elected president of the Chartered Company in succession to the late Duke of Abercorn.

Amalgamated Properties is one of the worst performances of Rhodesian mining finance. There is talk of reconstruction. We hope the company will be given a speedy sepulture. It was always rotten.

The Giant suspends dividends pending developments. We have never placed any confidence in the geological pabulum fed to the shareholders. It is quite likely, as Dr. Corstorphine now suggests, that the orebody is due to a secondary enrichment subsequent to the faulting of the lode. This is a suggestion that appeared in these columns in December.

The Shamva is compelled to ask for more

money before completing the plant, which is to start early next year, but the chairman, Mr. E. Birkenruth, is able to promise 40% per annum in distributable profits—a euphemism for dividends, we presume. Messrs. Ackermann and Pickering have visited the mine, and confirm the official deductions as to the ore available, but nothing is said concerning the estimate of operating cost. Even if the mine yields 40% on its capital (of £500,000), it will give only 16% on the market price, at £2½, with the assurance of only four years' production, equal to 64% of the money involved. The further persistence of the orebody in depth is entirely problematical, and the estimates of cost (total cost, not the cost of quarrying only) are, to our mind, by no means convincing.

The directors of the Golden Kopje and the Falcon mines have been perturbed by the results of inspections made on their properties by Messrs. A. H. Ackermann and Pickering, the one consulting engineer to the Chartered Company and the other to what may be called the Chartered Development Company. They found themselves unable to confirm Mr. H. A. Piper's estimate of the ore in the Golden Kopje. This is the property conspicuous in the humour of mining for a report ("endorsed" by Mr. Piper) in which the reserve was stated by two supposed engineers at so many tons of "more or less probable" ore. See our November issue. We do not wonder that Messrs. Ackermann and Pickering found it less, rather than more. As to the Falcon, that has been an iridescent enterprise from the start. The first statement of operating cost was much too low; it has been modified since, but still remains unconvincing.

WEST AFRICA.—The output of gold in May was 34,507 ounces, valued at £142,617. This is a slight decrease, but compares with £115,678 a year ago. Among individual mines the Abbontiakoon, Abosso, Broomassie, and Ashanti exhibit small gains, while the

Prestea and Taquah show slight declines. The dredges on the Ancobra did well, while those on the Offin river retrograded.

The production of tin concentrate in Northern Nigeria during May was 360 tons, as against 456 tons in April. The largest and most regular producer is the Naraguta with 70 tons per month. The Naraguta Extended yields from 30 to 40 tons; the Rayfield maintains an output of 25 tons monthly, while the Bauchi, Ropp, and Bisichi yield from 20 to 30 tons. The concentrate varies in richness, from 50 to 73% tin.

Mr. J. M. Iles, of the Rayfield, has inspected the Gurum River property and recommends the erection of an elevating plant. In the ground already proved he estimates 420 tons of 70% tin concentrate.

We regret to record the death of Walter Wethered, the brother of Mr. Oliver Wethered, and with him heavily interested in Nigerian affairs. He died suddenly at the Rayfield after having apparently recovered from illness, due to overwork.

The troubles incidental to mining in the tropics are exemplified by the Bisichi Tin Co., whose first manager lost his reason and died at the mine; then came a supposed hydraulic engineer from the Malay States, losing time and money; then a highly educated man took hold, only to collapse, mentally and physically. Since October Mr. H. P. Robertson, as manager, has been evolving order out of chaos, assisted by Mr. C. F. Trousdell. The property itself, we believe, has some merit, and gives promise of becoming one of the leading tin mines in Nigeria. From October to June the shipments of tin amounted to 365 tons of 73% concentrate. The ground has been systematically tested, and gives assurance of a considerable reserve of productive gravel. The old pipe-line has been re-laid, and a second line has just been added. Unfortunately, work was started at the top end of the gravel deposit, this fact by itself sufficing to

indicate the incapacity of the former management. Owing to late delivery of plant, a new start at the lower end of the property is postponed until next season, so that the mine will not attain its full rate of production before the wet season of 1915. Meanwhile the output will continue to increase. Water is abundant from the end of June to the end of November, the supply diminishing to dryness at the end of January. From April to June the water is intermittent. This, therefore, like so many of the Nigerian tin properties, is a wet-season alluvial mine. The facilities for working are said to be excellent and the concentrate is unusually high-grade. The only fly in the ointment is the inflated capital of the company, which, in this respect also, is like so many of the Nigerian enterprises. On the Ropp leases, we understand, the extent of rich ground is more restricted than is generally supposed, but the property is extensive, and other rich patches may be found later. The Forum is likely to do well under the new management. The chances of dredging on the Benue are not regarded as particularly promising, owing to the roughness of bedrock and the sporadic distribution of rich gravel. This is one of the reasons why inexperienced prospectors and amateur drill-men make mistaken estimates in Northern Nigeria. The bedrock is often both rough and irregular, with pot-holes, in which pockets of rich gravel are deposited, making any ordinary test highly delusive.

By paying £78,000 out of returns from the mine, the Taquah has decreased its debt to £50,000; and as it has been arranged to liquidate this loan in payments spread over a term of years, the shareholders are now without sight of dividends.

The Abosso lode has been cut on the 13th level and assays 59s. per ton over 5 feet. This is good, and compares well with the exposure on the level overhead.

The output at the Ashanti Goldfields continues to be below the average, the figure for

June being £35,322. The scarcity of wood-fuel has been the cause of reduced output for several months; this trouble has been removed by more wood-cutters returning to work. Another source of anxiety has in the meantime intervened; owing to a fall of rock on the No. 5 level of the Ayeinm mine, which caused the deaths of one European and six natives, it has been difficult to keep the full underground force together.

AUSTRALASIA.—Judgment in the case of the London & Hamburg Gold Recovery Company against the Golden Horse-Shoe has been delivered, but the cable message giving the result is not sufficiently clear to make it possible to obtain the true interpretation. It states that the plaintiffs have lost on the Sulman-Teed patents and won on the Goepner-Witter patents. Both sides are appealing to the Judicial Committee of the Privy Council. The Sulman-Teed patents relating to the process for using bromo-cyanogen for the rapid extraction of gold from refractory ores have been held as valid hitherto, and users have cheerfully paid the royalty, the Golden Horse-Shoe being the solitary exception. The Goepner-Witter process consists of the production of bromine and bromo-cyanogen on the spot from bromide and bromate of soda, the advantage being that these salts form an excellent vehicle for the transport of the two chemicals from Europe.

In our May issue we announced that the Zinc Corporation had adopted the process invented by Mr. James Lyster for the flotation of galena from the slime of the lead-mill. The company has more recently acquired the rights of Mr. E. J. Horwood's process for roasting slime from the zinc tailing, in such a way as to coat the galena contained in it with sulphate and so make it unamenable to flotation. The adoption of these two processes marks a step in the concentration of Broken Hill ores.

Mr. George P. Doolette made an interesting and cheerful speech as Chairman of the

Great Boulder, but we do protest most strongly against the absurdity of stating the ore reserve with such meticulous precision, namely, 652,616 tons averaging 14'5973 dwt. per ton. If he said 650,000 tons at 14½ dwt., he would be stating the estimate within the limits of probable accuracy. Neither he nor his distinguished consulting engineer, Mr. Richard Hamilton, can make a calculation within a thousand tons or within half a pennyweight per ton in any large mine at Kalgoorlie. The pretence of accuracy is likely, unintentionally, of course, to mislead shareholders, who may think that ore in the ground can be weighed and valued to a nicety far beyond the skill of any engineer, however experienced. It is a pity that the Great Victoria proved such a disappointment. Renewed efforts are being made to rejuvenate the Great Boulder by the acquisition of a young and promising property elsewhere. Two are being examined at this time. A proper appreciation of the services of the manager and the staff was shown by the directors and the shareholders. Such action is never a mistake.

Recent exploratory work in the Victorious mine, of the Associated Northern Blocks, indicates that the ore-shoot is shorter than was hoped. Some of the high assays were illusory, for they represent only patches, not an extension of the orebody.

Great Cobar has had bad luck lately; indeed, the shares have fallen ever since they were lifted by Mr. Herzig's favourable report. Many causes have contributed, chiefly a dread of the debenture-holders. However, a turn for the better can now be recorded. Mr. H. C. Bellinger contradicts the rumour concerning a collapse of the main shaft. He asserts that the shaft is in excellent condition and that connection for ventilation is being made between the Great Cobar 12th level and the Great Cobar North shaft. The supply of labour has improved. It is also announced that Mr. Bellinger has renewed his contract,

as general manager, for another three years. As his services are exclusive, this kills the story of his becoming consulting metallurgist to the Mount Morgan.

The finding of good ore on the 310-ft. level of the Bullfinch Proprietary is reported. This mine is exhibiting signs of recovery. However, it is patchy; hence, high assays must be accepted with reserve.

INDIA. — Another orebody has been discovered in the tract of country owned by the Anantapur Gold Field company. This is in the South Ramagiri block. The lode has been proved on the 200-ft. level for a distance of 65 feet, the ore averaging 1 ounce over 18 inches. As the ground is broken, the shaft is to be sunk another lift. This company has already provided two gold mines, the North Anantapur and the Jibutil.

CANADA.—The yield of gold from the Klondyke in 1912 is stated officially at \$5,225,235, as against \$2,983,835 in 1907, which was the lowest recorded since the early days. The Yukon Gold and the Granville were the principal operators. The Lone Star worked a 4-stamp mill on vein-quartz yielding \$3'74 per ton, leaving only a nominal profit. Some high-grade ore is said to have been found near the Stewart river.

The new smelting plant of the Mond Nickel Company, at Coniston, Ontario, was put into commission at the end of May. Additional properties in the neighbourhood of the mines at Sudbury have been acquired, and others are being examined. The refining works at Swansea are being extended.

UNITED STATES.—Our New York correspondent sends interesting details concerning the Chuquicamata and Braden copper mines, both of which are controlled by the Guggenheim Exploration Co. Our San Francisco correspondent refers to the Consolidated Gold Fields' operations and to recent results from the Yukon Gold.

The decrease in Camp Bird profits is ex-

plained officially by the large amount of unrealized concentrate and bullion, and also by the low grade of the ore recently milled at the Santa Gertrudis. In February the insurgents interfered with the operation of the refinery in Mexico City. Thus the returns from February to May are disappointing. The lack of information is having a bad effect on shareholders, who are also by no means pleased with the new departure whereby the Camp Bird becomes a general holding company for various financial activities.

Oroville Dredging held its annual meeting on July 14, but it was a purely formal affair, in the absence of reports from the general manager. Why does he (Mr. W. P. Hammon) not send his reports promptly? It is a pity that the American management antagonizes English shareholders by giving information both incompletely and dilatorily. Only three dredges are now in operation at Oroville, and the company's prospects have become centred on success in Colombia, where the dredge on the Pato concession started digging in December. But the returns published are fragmentary and quite unsatisfactory.

MEXICO.—The insurgents are reported to have captured Durango, Matamoros, and Zacatecas. A battle for three days near Ortiz, in Sonora, ended in the defeat of the Federals, of whom 4000 surrendered. This strengthens Carranza, who now dominates the northern states. The railways are in a state of fearful congestion; a fact that led to the rumour that the National Railways had passed into a receiver's hands. It was officially denied. But transport in Mexico at present is most precarious.

As we go to press, we learn that railway communication is restored between Mexico City and Laredo, on the American border. The rebels have been driven off the Tampico line, thus ensuring the supply of oil-fuel to the National Railways.

Mexican shareholders are said to be dis-

satisfied with the information given by the Esperanza management, especially in regard to the San Carlos vein. We have received a letter, unsuitable for publication, protesting against the contradictory and insufficient character of the official reports. "Collusion for ulterior purposes" is suggested, but this we believe to be fanciful. However, we are glad to insert a *caveat* for the sake of all concerned.

The dredge on the Orsk Goldfields is again at work, but the information published is lamentably defective. The value of the gold produced means nothing until the expense is stated. Shareholders are left in the dark.

On the Sissert estate the diamond-drilling operations have been unfortunate, such results as have been obtained since July being disappointing. The various mines are to be linked by a railway. It is announced that Mr. August Hoffmann has died recently. We record the fact with deep regret, for he was an able and conscientious engineer. Mr. N. C. Stines is now resident engineer.

At the Lena Goldfields the new manager, Mr. Leon Perret, is hopeful regarding the future of the property. His efforts to improve the technical methods will undoubtedly be supported by the advice of Mr. C. W. Purington, who is just making an inspection.

CORNWALL.—Application was made on the 4th inst. to the High Court for the appointment of a receiver and manager for the Fal-mouth Consolidated, and the court agreed that Sir W. B. Peat, head of a leading firm of accountants, should undertake the duty. The company has an issue of bonds, which at the present juncture require protection, pending the re-organization of capital.

VARIOUS.—While mining generally is dull, for obvious reasons, the interest in dredging has grown surprisingly. A number of dredges for Servia, Nigeria, Malay States, Siam, and Chile, have been ordered. If the operations of the Consolidated Gold Fields in the plati-

num region of Colombia, in the San Juan watershed, should prove successful, it is likely that a big increase in this branch of mining will ensue.

The Renong Dredging Co. has been re-organized, changing its name to the Renong Tin Dredging Co. Additional money to the extent of £30,000 has been raised, in order to enlarge the scheme of operations and to exploit the additional area of 1400 acres recently granted by the Siamese government. The performance of the company so far has been highly satisfactory, about 80% of the original money involved having been returned in dividends. Extraction of tin has been effected by a 12-cu. ft. bucket-dredge built by Werf Conrad. About 20 acres has been worked, and of the original concession about 120 acres remains, all of it having been drilled and proved profitable. Of the new ground, over 100 acres has been drilled with similar results. Two new dredges have been ordered from Werf Conrad on the understanding that both shall be delivered before April next. The yield is from 12 to 13 oz. black tin per cubic yard, and the dredging cost is 3½d., but the total cost, including royalty at 2d. per yard, is about 7d. per yard. The resident manager is Mr. Frank Nichols.

Abnormal rainfall has hindered operations at the Tronoh, Lahat, and other tin alluvial mines in the Malay States.

Conditions at Rio Tinto are bad, and may become worse. The stabbing of Mr. Richard Sturgis, a member of the engineering staff, was not fatal, we are glad to say, but it is a sign of an unruly temper among the employees. A vexatious regulation imposes the speaking of Spanish even on the company's private telephone lines. The Spanish authorities are not in sympathy with the management of Messrs. Fielding and Browning. The recent strike at the Huelva docks may be the prelude to worse disorder unless tact is exercised.

EDITORIAL

FORMER STUDENTS in the Royal School of Mines are urged to attend the general meeting on July 22 at the Mining & Metallurgical Club. It is proposed to form an Old Students' Association.

AMONG the items of mining news appearing in the *Daily Telegraph* is one stating that the ore in the Phoenix Mines yielded 84·5 lb. metallic tin by chemical assay and 58·5 lb. tin by "canning" assay. The error is obvious, but it suggests the relation between 'canned' and 'tinned' vegetables.

PART of the discrepancy between "profits" and dividends is due to expenditure on machinery and equipment, such as is required periodically by all live mines. During 1912 a sum aggregating £1,264,728 was thus absorbed as capital expenditure by the 30 companies operating on the Rand.

SUBSCRIPTIONS to the 21st anniversary fund of the Institution are accumulating satisfactorily. Many of those abroad have not yet had the chance to remit and many others who are deterred by their inability to subscribe largely are delaying remittance. The last circular is not happily worded; it should be understood that the Wernher bequest of £10,000 cannot be expended; only the endowment is available.

CONSOLIDATED GOLD FIELDS of South Africa is a company that has suffered in public repute by reason of some of its market operations, and it has had to face several disappointments during recent years, therefore it is pleasant to chronicle a more fortunate development of its industrial activities in America. Our correspondent at San

Francisco gives some interesting details, indicating that the American representatives of the Gold Fields, Mr. H. H. Webb and Baron de Ropp, have done well for their company. We hope they may retrieve the fortunes of an enterprise that played so prominent a part in the exploitation of South Africa.

IT IS about time that some of the members of the Institution of Mining & Metallurgy woke to the fact that their professional organization is called the Institution, not Institute. We have recently received a letter from a student-member who prints "Institute of Mining & Metallurgy, Salisbury House, London, E.C." on his letter head. Gentlemen, it is THE INSTITUTION.

WE PUBLISH a valuable article by Messrs. R. E. Smith and H. G. Hann, describing the drilling of alluvial ground in Siberia during winter. This furnishes just the practical details that an engineer—or an intelligent director—would require. For such articles not only the technical press but the profession at large can afford to express cordial thanks.

WITH this issue we begin our 5th year and our 9th volume. To signalize the occasion we make two additions to the reading matter in this magazine: henceforth a page will be devoted regularly to the affairs of the Royal School of Mines, and a summary of the principal quotations of mine-shares will also be inserted. The latter will be interesting to those living in distant countries, and by giving comparative quotations the page will arrest the attention even of those living at home. For giving a page to the Royal School of

Mines we do not apologize. The premier mining college of the Empire deserves the interest and support of the mining community ; and it needs them. We feel confident that the news that we can publish concerning the School and its affairs will prove interesting to our readers generally, and we hope that it may serve to pull the old students together in an effort to help themselves and their alma mater at South Kensington.

WHEN reading quotations from local papers commenting favourably on mines controlled by English companies, it is well to inquire whether the information on which the comment is based was not furnished by the company's local representatives. When an extract from the *Poverty Flat Boomster* is read at the annual meeting of the Great Wild-Cat Extended, it is advisable to treat the performance as humour, not business.

MAKE-BELIEVE, insincerity, or imposture are all injurious to journalism. We regret that the *Westminster Gazette* should disfigure its front page, on which appears the most convincing editorials written within London, by giving part of its space to the pseudo-literary efforts of Selfridge's. The advertising manager dates his advertisement from "editorial rooms" and maintains the pretence by a daily pabulum of piffle. The animal department is called a Cat and Dog Salon ; why not Saloon ?

FURTHER diplomatic appointments made by the President of the United States include Messrs. Thomas Nelson Page and Henry van Dyke, both well-known authors, and Mr. P. A. Stovall, publisher of the *Savannah News*. These appointments, added to those already made, notably that of Mr. W. H. Page as ambassador to England, emphasize a pleasant feature in American political life. It is a feature full of interest

and one that must be highly gratifying to the brothers of the pen. As George William Curtis said : "If a scholar is not always in office, he is always in power." And if he can combine the power with the opportunity to apply it, he may hope to be effective. Edmund Garrett said that two things made life worth while : friends and the hope of being effective. That being so, we congratulate the new minister to the Court of St. James, for he gives evidence of the double accomplishment.

HONORARY MEMBERSHIP in the Institution has been conferred on Mr. J. J. Beringer. This is a distinction that can hardly give more pleasure to the recipient than to his many friends, not only in Cornwall but wherever the sons of the 'old county' are doing the work of the mining industry. His book on assaying is standard ; it has carried his name to assay-offices and mining schools in distant places ; it is a memorial to his place in modern technology, but his students are a living memorial to his skill as a teacher and his kindness as a friend to those who have passed through his classes at Camborne. The good repute of the Cornish school of mines is entwined with that of its metallurgical professor. May both live long and prosper, for the benefit of the rising generation.

IT IS not often that mining shares are quoted at a price that gives the purchaser a good run for his money. In ordinary times the inexpugnable optimism of the poorly informed speculator causes mines to be overvalued from 20 to 50% ; in times of speculative excitement the shares of mining companies are quoted anywhere from 100 to 300% above their real value ; and it is only in periods of prolonged depression that the shares of rich mines are available at a price yielding the public a fair return and a reasonable security. That is the very time when the public keeps

aloof, allowing the courageous and better informed operator to acquire large holdings at about intrinsic worth, as nearly as that can be gauged. Such aloofness of the public is pitifully contrasted with the wild scramble to buy when shares have been kited during periods of inflation, which is also the time when the sagacious operator decides to turn paper into cash. These adjustments between the few who are wise and the many who are otherwise will be repeated to the end of the chapter. The month of July in the year 1913 will illustrate them admirably.

The Institution.

Members of the Institution of Mining & Metallurgy, and the profession generally, will be glad to learn that permanent quarters have been secured by the purchase of the freehold property known as No. 1 Finsbury Circus. This is a five-storey red building at the corner of West Street, opposite the west end of Salisbury House. After the building has been renovated and altered to suit its new tenants, the offices of the Institution will be moved thither from the present quarters in Salisbury House. The change will be made about the end of this year.

This new departure is not only interesting as evincing the growth of the Institution, which is in need of larger offices, but it is deeply significant as testifying to the stability of the organization. We shall henceforth possess an outward and visible sign that the profession has achieved an honourable status in the city of London. The man-in-the-street is apt to look upon mining engineers as nomadic and adventurous persons connected with queer doings on the Stock Exchange. The establishment of respectable headquarters may correct one exaggeration and the effort to crystallize a code of conduct may serve to correct the other exaggeration. In any event, we shall be expressing the gratification of all who have at heart not only the well-being of the profession,

but the dignity of the metal mining industry, when we proffer hearty congratulations to the council of the Institution in having acquired a fixed home. May the event prove to be the beginning of a new era of expanding usefulness.

Globe & Phoenix.

This Rhodesian mining company is unfortunate. The pitiful squabble over directors' fees has been resumed. It is discreditable both to the shareholders and the directors. If the members of the board are efficient, it is silly to agitate over £100 per annum more or less; if they are not efficient, any fee is too high. At the last conversazione of the Globe & Phoenix company, one eminently sane suggestion was made by a lady, who said that "any extra money spent on the remuneration of directors should be in the direction of paying for the services of men who knew something about mining, and who could work the property with advantage to the shareholders." In America the appropriateness of the lady's name, Mrs. Lemon, would be keenly appreciated. Even in London the sub-acid flavour of her suggestion will not be missed. Indeed, she is as wise as the Queen of Sheba. Why elect five, seven, or nine directors without adequate experience, but all demanding reasonable remuneration, when three men versed in mining affairs could do the same work, and do it better, at no greater cost than that incurred in maintaining a large board of well-meaning amateurs. It may be that the present board includes three men with such qualifications; then it would be well to reduce the number of directors and thus effectively meet the cry for economy.

Since the above was written it has been announced that Mr. T. Blair Reynolds, the chairman of the company, has resigned. We are sorry for this, for Mr. Reynolds gave the impression of being earnest and conscientious. With his resignation a compromise has been

reached on the basis of a fee of £400 per annum for each director, plus travelling expenses. It is also stated that an eminent Fifeshire colliery-owner has been selected to visit the mine and report to the shareholders. We hope this is not true. A colliery may be an excellent place to learn mining, but it is not the best place to acquire experience for valuing gold mines or advising on the operation of them, especially in Rhodesia.

The Rand Strike.

The story of the labour trouble that started at the Kleinfontein mine on May 26 and culminated in mob violence in Johannesburg itself on July 5 is not easy to tell. It is, however, necessary to record the facts before expressing an opinion. On May 26 the manager of the New Kleinfontein mine changed the hours of work for five underground mechanics. Formerly they worked from 7 a.m. to 3.30 p.m. every day, except Saturday, when they finished at 12.30. The new proposal was that they should begin every morning at 7.30, or half an hour later, but continue until 3.30 on Saturday. No increase of working time was involved. The aggregate of $2\frac{1}{2}$ hours taken from five days was added to the Saturday afternoon shift. The half-holiday was lost. That was all. But it was enough. The five men persuaded others to stop work. The Kleinfontein miners went to the adjoining Apex mine and induced those at work there also to strike on May 31. Thereupon the Kleinfontein management engaged some 50 men to replace the strikers, and operations proceeded simultaneously with negotiations for the settlement of the dispute. But the trouble was spreading. On June 19 the men at the Van Ryn were intimidated into ceasing work, although a large majority voted against it, and on June 21 the force at the New Modderfontein in like manner was induced to 'come out.' Mass meetings began to be held, bitter feeling was engendered, and the area of

disaffection widened, until on the last day of June it became apparent that the whole mining industry of the Witwatersrand was about to be paralysed completely. The original grievance receded into the background. The Kleinfontein management had done all it could to remedy a blunder, but the men were now excited by the speeches of agitators. They made new demands. It became clear that organized labour thought the time opportune to demand the recognition of the all-embracing Federation of Trades Unions. Those who did not sympathize were assaulted. Lawlessness obscured the issue. All the unruly elements in a cosmopolitan community went on the warpath. The local authorities were slow to afford necessary protection to law-abiding workers, and the Government itself did not realize the gravity of the crisis until it broke on the city of Johannesburg in midnight scenes of incendiarism, terrorism, and mob violence. On July 4 a mass meeting was dispersed by municipal police and Imperial troops. A series of armed conflicts ensued during the rest of that day, and on the day following. The mob broke into the railway station, the Rand Club, the office of *The Star*, and other important buildings, obstinately contesting the possession of the streets against both police and soldiers. Late on July 5 the Prime Minister and General Smuts held a conference with the strike leaders, and persuaded them to join in re-establishing order, on the understanding that the Government would enforce a reasonable settlement of the dispute.

The labour employed on the Rand consists of 225,000 units, of which 200,000 are Kaffirs or natives, and 25,000 are white. Thus the Kleinfontein mine in April employed 4719 natives and 466 whites. The latter are Cornishmen, Welshmen, Northumbrians, Africans, Australians, Americans; they are skilled workmen. The native is the manual labourer, the white man is the overseer or boss. It is the white finger that directs the work

done by the black hands. The native is paid 2s. per shift, and is housed and fed in a compound. He costs £4 per month. The white worker receives from £27 per month at surface to £75 or more per month on contract underground. He finds himself in food and lodging. No question of poor pay can arise, for the white miner on the Rand is paid extravagantly, as measured in terms of toil and performance. Whence then this turmoil?

In the first place, the work, if not severe, is rendered unhealthy by the dust, the minute hard particles of which cause phthisis to such an extent that no man who works in the mines is immune. Scientific inquiry and systematic effort have been applied to the mitigation of this evil; and not without success. But the palliatives—sprays of water on the rock and respirators on the miner's mouth—are not used with sufficient diligence, so that the beneficial effects have not been felt fully as yet. However, these and other correctives for the evil are now being applied systematically. Indeed, phthisis would give a humane touch to the problem of labour unrest if it were the dominant factor. It is not. Reasons more sordid exist. The efforts of the local authorities to protect and control the native workers and to check the growth of social evils have aroused antagonism. The proposed restriction of the Kaffirs to closed compounds would interfere with the illicit sale of liquor; the suppression of the more vicious exhibitions of the bioscope, the regulating of the more extreme forms of gambling and gaming, the limit placed on various kinds of debauchery, have all antagonized the baser sort that makes money out of the dissipations of a mining community. Hence a quick recruiting of reckless spirits to the mutiny of labour. The riots did not occur at the mines, but in the city of Johannesburg, and the casualty list consists largely of names belonging to the foreign riff-raff and half-breeds from the Cape.

Again, the Labour party, small as is its

present representation in the Union parliament, is a growing force, and has enough votes behind it to cause political complications, creating fresh difficulties in the way of a fair consideration of a basic problem. That problem is fundamental, for on efficient labour depends the whole economic structure of a complex industry. The ore of the conglomerate deposits of the Rand is becoming poorer in depth; it is also becoming more difficult to exploit as depth is gained. A diminution in cost is imperative if the industry is to continue profitable. The white workers are obstinate in their refusal to co-operate to that end. When new machines of special construction are provided or other efforts are made successfully to improve the implements used in the extraction of the ore, it is with the hope that the white supervisor of the black man's labour will assist in making the results more favourable economically to the employer, that is, that the cost of drilling, for example, will be cheapened for the company. This expectation has not been fulfilled. The white miner on day's pay insists on drilling just as much, and no more, rock than before.

Another factor is the centralized control of operations. The administration of groups of mines by various financial houses and the amalgamation of contiguous properties into super-enterprises has tended to diminish the prestige of the managers of individual mines. The engineer at the head office is the directing mind and the consultative chief. To him each subordinate looks. Hence the resident mine manager has lost in moral authority, and is less able to cope with his employees at critical junctures. This is a regrettable result ensuing from the centralization of technical control.

Finally, we come to the arbiter between these unruly factions. The Government is to blame for suggesting, or allowing it to be inferred, that it would not interfere unless extreme measures were taken by the labour

union. Whatever the rights and wrongs of a complicated industrial dispute, it is the first duty of a government to maintain order. Whether in Mexico or in the Transvaal, it is the policeman, not the legislator, who is the symbol of civilization. Of all maleficent forces, an unruly mob is the one that needs to be checked earliest. Too many police and an excess of soldiery is better than too few at such times. Prevention is better than cure for anarchy as for other diseases of the body politic. This is a lesson that democratic governments are slow to learn. The making of laws is a function secondary to that of maintaining the law. Especially is this an axiom when white men fight each other in the presence of a horde of savages. The spectacle exhibited to the natives on the Rand is not edifying, to put it mildly. Mob violence is bad enough anywhere, but incendiarism and assault before a gallery of 200,000 Kaffirs is a performance that makes dancing on the edge of a volcano seem a highly sagacious proceeding. That is one of the considerations to be kept in mind. Economic justice is another. Industrial freedom is a third. And the safety of world-wide credit is one more, for the continued paralysis of the Rand would mean such a freezing of the channels of commerce as the modern world has never seen. The problem is worthy of the highest statemanship.

Mexico.

In commenting upon Mexican affairs, month after month, we become weary of the iterative story of political disorder and industrial disorganization. It is plain that this great mineral region is no longer suffering from political disturbance, but from plain anarchy. Most people, even the few patriotic citizens in the country itself, have ceased to take sides on the political issues underlying the revolution that unseated Porfirio Diaz; all that they ask now is security of life and property, so that they may go about their daily work un-

hindered. The maintenance of law is the first requisite of industry. The policeman, not the legislator, is the symbol of modern civilization. Even the despotism of Diaz evoked no effective opposition until it was used to aid the so-called *cientificos*, the international group of predatory promoters who were exploiting Mexico in a manner too flagrant to be endured by the Mexicans. When Madero led the opponents of the Diaz regime to a successful revolution, he also failed because he did not enforce the law. Whether a genuine reformer or not, he was a feeble administrator. He departed tragically, and now General Huerta, first his friend and then his enemy, is in the presidential chair, supported by General Felix Diaz, who at one time seemed likely to grasp the reins of power held so long by his uncle. In the present cabinet are Señor de la Barra, as Minister of Foreign Affairs, and Señor Esquivel Obregon, as Minister of Finance. These are the mainstays of the existing government. The recent appointment of General Blanquet, as Minister of War in place of General Mondragon, has been well received, and is taken as a sign that President Huerta will have his support in the further pacification of the country. Meanwhile, General Carranza, in the North, is holding the border states against the Federal troops, and is gradually gaining in prestige. It does not look as if the Government, or any possible native government, would succeed in establishing order. The issue of a loan for £6,000,000, or 60,000,000 pesos, will provide funds, it is true, wherewith to buy-off the leaders of the brigands and to recruit an army of mercenaries, but Mexico can never have peace until her people develop more manhood than is apparent now. A handful of bandits, mostly Indians, can hold up a town containing several thousand able-bodied men; the latter look on helplessly, even though they themselves are armed, while the marauders steal, burn, and outrage; when all is over a telegraphic message is sent to the

Government asking for troops. It is pitiful. The half-breed population is educated enough to object to despotism, and not virile enough to support the military government, which is the only kind of government possible at this juncture. If General Huerta fails, or if he is removed by another revolutionist ambitious of power, he will be succeeded by one of the military leaders, who in turn will have to fight his predecessor's supporters. Thus the cat-and-dog fight will continue interminably, and at every successive stage the condition of general anarchy will be intensified. We despair of order in Mexico, because the people of Mexico have proved wholly unworthy and incapable of representative government. A military despotism is the only alternative, but even that brings no promise of stability, for the military leaders are too selfish and too greedy to support one another for the good of the country. Every day we draw nearer to the inevitable: the interposition of the United States.

The Mining Malaise.

In these days of the *entente cordiale* we feel warranted in borrowing from our French friends; we do not need to borrow money, but we are glad to trespass on international courtesy to the extent of asking them to lend us a word or two when we are hard put to it for a means of expression. Thus, being at a loss to describe the prolonged unhappiness of the mining market, we shall join with others in calling it a *malaise*. Having given it a polite name, let us diagnose the symptoms and suggest a remedy.

The *Pall Mall Gazette* says: "Mining shares are hopelessly out of favour. Disappointment has disillusioned the public. There is more than a suspicion of unfair tactics on the part of the controlling interests. Scandal has succeeded scandal. The public have had enough of it." This verdict need not be regarded as final, but it undoubtedly

gives expression to the feelings of a number of persons who speculate in mines and call themselves 'investors.' Times of depression are good for introspection. "When the devil was sick, the devil a saint would be." Hence our financial scribes and others who have played a part in stimulating public speculation are now passing sombre judgments on those, besides themselves, who are responsible for the supposed lack of confidence in the business of using money for mining. During the last four years we have discussed the subject often; we have animadverted on the insincerity of some directors and the ignorance of others; we have blamed the recklessness of promoters and the cowardice of shareholders; we have protested against the gullibility of the public and the general perversity of human nature. But we have come to the conclusion, not hastily, that the only way in which to improve the business of mining is to raise the standards of professional conduct among those chiefly responsible; and this does not refer to the promoters or to the directors, but to the mining engineers. After all, it is from the engineers that the directors and promoters must take their cue. The reckless promoter or the tricky director cannot do much unless he finds a complacent engineer to give technical verisimilitude to his oblique performance. A straight engineer of strong character can draw the line for promoter and director alike. The best hope for the mining business lies in the stiffening of the moral backbone of the mining profession and a general recognition by the public of the fact that the mining engineer with clean hands is the man to whom he can look for protection as against the predatory financier. On the other hand, the honest financier and the honourable promoter, both plentiful and both necessary to mining, will get a better chance to do business when conditions are made more difficult for the less scrupulous of their kind. Promotion and finance, as regards mining, have improved in

character during the last twenty years, and this improvement has come with a raising of tone among the members of the mining profession. If we hear of scandals, it is mainly because the sense of decency has improved. Twenty years ago the scandal of today would scarcely have made a flutter; on the other hand the scandal of an earlier generation would end today, not in newspaper articles and abortive shareholders' protests, but in goal. The general morality of the business of mining is better and the public acquaintance with the elementary facts of mining and metallurgy is wider today than ever before. We are optimists because we have been talking to pessimists. "The optimist sees the dough-nut, the pessimist sees the hole." The philosopher sees life sanely, and sees it whole. The business of mining is essential to civilization; it will not cease because a few lambs have gone astray in Throgmorton Street.

The Future of the Rand.

Another record production of gold on the Rand has been chronicled without the slightest sign of elation. Time was when such an event would have evoked enthusiastic comment, but in these days of grim disillusionment no one attempts to make a bull argument out of a statistical fact. The continued increase in the gross production of gold has ceased to indicate a proportionate gain in dividends. The glory has departed. These are dull days in the Kaffir market. The spacious days of expanding financial activity have given place to the dreary shrinkage of disappointed realization. The Rand is still the premier goldfield of the world and a potent factor in the money market, but the joyousness of exuberant youth is gone for good. Now, if ever, it is on an investment basis. Quotations have dropped to a figure indicating that the hot air of rising inflation has been expelled. The lives of the mines have been estimated with discerning accuracy. Shares are cheaper than they ever

were, but the public holds back; and not unwisely, for the element of the unexpected, formerly so delightful, has now become a sombre menace. The unforeseen now predicates the unpleasant where formerly it only contributed to buoyant expectation. None know this better than those most deeply interested.

These reflections receive point from the article by Mr. G. A. Troye appearing on another page. This article is an abstract from a detailed and voluminous appraisal of the mines of the Rand prepared by Mr. Troye and not intended originally for publication. For this reason, and the fact that Mr. Troye is an engineer not identified with any of the financial groups, it is both interesting and timely. We find that Mr. Troye's appraisals are not depressing, at least not at this time when every depressing factor has had full play. For purposes of comparison we give the market quotations, in shillings, on June 30 and on January 31, the latter being the date at which Mr. Troye prepared his estimate. In a third column we give that engineer's figures.

	January 31	June 30	Troye
Brakpan.....	90	66	80
City & Suburban	45	50	60
City Deep.....	67	56	64
Con. Langlaagte.....	29	26	42
Con. Main Reef.....	26	18	20
Crown Mines.....	146	136	100
East Rand.....	60	51	30
Ferreira Deep.....	66	60	60
Geldenhuis Deep.....	26	31	20
Heriot.....	77	65	90
Meyer & Charlton.....	108	102	80
New Modderfontein...	257	247	230
Nourse	39	32	33
Robinson	72	62	60
Robinson Deep.....	45	32	42
Rose Deep.....	65	60	49
Village Deep.....	45	41	25
Wolhuter.....	18	16	17

From these it will be seen that of the 18 mines mentioned, only two stand higher in June than in January, and only 8 are now quoted above Mr. Troye's estimate. Of these, the East Rand and Village Deep exhibit large discrepancies, while the Crown Mines and Meyer & Charlton show minor differences. [This was written before the strike.] We note also that Mr. Troye values the Brakpan, Consolidated Langlaagte, and Heriot considerably above the market. Of course, all these estimates are fallible, for all are dependent on several unknown and indeterminate factors, but it is interesting to see that fully half of the leading mines of the Rand are now quoted at a value lower than that placed upon them by an independent appraiser. Turning from individual mines to the future of the Rand as a goldfield, it will be seen that our critic predicts a steady decline in productive activity after the current year. Productive activity, of course, is measured by dividends and not by illusory 'profits' on paper. In his general forecast, we agree with Mr. Troye. Is it not written plainly on the stope-sections of the Rand? The decline will be slow at first, but accelerated after another decade. But that does not mean the end of the mining industry in the Transvaal, for base metals will be produced in larger quantity than today from mines tributary to Johannesburg. However, that is a long way off; it is well to take short views in mining.

Turning again to the immediate foreground, we note that, of the financial groups, two, the Gold Fields and Neumann, have no particular prospects. The Goerz company has an interest in Modderfontein Deep and a doubtful asset in Geduld. The Central group has the City Deep, Modderfontein, Modder B, and Crown Mines, all of which may be regarded as sound business. The Albu group has the Meyer & Charlton, with Van Ryn as a second string. The Consolidated Mines Selection can boast of the Brakpan and possesses good

chances in the Springs. The Barnato control has the Consolidated Langlaagte and the Van Ryn Deep. The mines with a promise represent a big mining development, but they are pitifully few when compared with the splashy energies of an earlier epoch. Those best informed realize the need of a new field for the well organized activities so long and so successfully associated with the Witwatersrand. It is a pity that they failed to participate in the recent notable growth of low-grade copper mining in North and South America, instead of running their heads into the jungle of West Africa. The Gold Fields is making a new start in America. In this respect an excellent example has been set by a company that of late has mostly failed to be the exemplar of good methods. The world is still young and its mineral resources have not all been uncovered. If the leaders of the Rand mining industry desire to perpetuate their useful enterprise, they must go farther afield.

Murex Magnetic.

Four years ago the Murex process of ore concentration was used on the Stock Exchange for the purpose of creating a wild and ridiculous gamble. In our second issue, that of October 1909, we gave a description of this process, based on an inspection made in company with the inventor, Mr. A. A. Lockwood, the consulting engineer, and the managing director, all of whom were freely communicative and readily replied to all inquiries. The impression we then obtained was favourable to the process, though its limitations were obvious. The boom on the Stock Exchange was quite unwarranted, and in our editorial columns we recorded a protest at the time. It is important, however, to say that the directors were in no way implicated in this unfortunate boom, and that no one regretted it more than they did. There can be no doubt that the boom exercised an adverse influence on the fortunes of the company, and caused

engineers to look with suspicion on a process that has a real scientific basis. Last month the company was re-organized, and a small amount of additional capital has been subscribed in order to continue the business until a substantial income from royalties commences, and to further test the process and its applications. Mr. Theodore J. Hoover has been engaged as consulting engineer, and his intimate knowledge of concentration practice should help to push the process forward and to indicate its exact place in metallurgical practice. The object of the Murex process originally was to concentrate sulphide ores that are not amenable to ordinary flotation methods, either because of excessive sliming or of the presence of carbonates that neutralize the action of the acid in the flotation agent. The concentration of the minerals is effected by mixing a pulp of crushed ore with an emulsion of residual oil and magnetic oxide. The mixture is agitated until the emulsion or 'paint' adheres to the mineral particles that have a selective attraction for it. The pulp is then passed under an electro-magnet, which lifts the painted particles, thus effecting a separation. The process has been successfully applied at the Cordoba copper mine in Spain, at Malines in France, and at the Grund mine in the Hartz mountains, Germany. At many other mines the results are sufficiently promising to warrant application on more than the experimental scale. The point of greatest interest, however, in connection with the process is that it is applicable to the concentration of carbonate and oxide ores. How wide this application is cannot as yet be determined, and we can only quote one case, the Whim Well copper mine, in Western Australia, where the results are fully established. This mine has been producing copper ore for seven years, and, by means of picking, a large quantity of ore containing from 10 to 30% copper has been shipped regularly to European smelters. The rest of the ore mined, averaging

6% copper, has been placed on the dump. No method of mechanical concentration gave any help in the beneficiation of the ore. Mr. Edgar Anderson, the chairman of the company, approached the Murex company in its earliest days with a view to testing the applicability of the process to carbonates and oxides, and after much experiment it was found that a concentration could be effected. A plant with a capacity of 200 tons per day was ordered. When it had been erected further difficulties supervened, due to the impossibility of dewatering the crushed ore owing to the presence of colloidal matter from the kaolin in the ore. This has now been remedied by the provision of dry-crushing plant. The method of working the process as now determined at Whim Well consists in crushing the ore in jaw-breaker, rolls, and Hardinge mill in a dry condition. The ore is crushed fine enough to pass a 24-mesh screen and the aperture of the rolls and the discharge from the conical mill are arranged in such a way as to produce as little *minus* 60 material as possible. The crushed ore is delivered to Murex agitators together with 40% by weight of water, and then the magnetic 'paint,' with a small proportion of oleine and silicate of soda, is slowly added. It is found that if a more dilute pulp is used, the 'paint' will not properly adhere to the mineral. The oleine and silicate of soda are essential, for without the semi-saponification induced by them the oil would fail to be a sufficiently active agent with the carbonate and oxides. About $1\frac{1}{2}\%$ of oil and 3% of magnetic oxide are used. The company owns a deposit of hematite, which is roasted at the mine for the production of magnetic oxide of iron. The recovery of this oxide from the concentrate is profitable, for the cost of producing it is comparatively high, and in addition, the removal of it reduces the cost of freight by rail and sea. The scheme in connection with this plant involves the treatment of the whole of the output of the

mine, which will be regulated to average 52 to 6% of copper, and produce a concentrate averaging 20 to 25%. The recovery is expected to be somewhere between 75 and 85%. The concentration of oxidized ores at Whim Well will mark an interesting epoch in metallurgical practice, and will bring the Murex process into prominent notice.

St. John del Rey.

It is only a few months ago that we gave an outline of the history and present position of this wonderful old gold mine in Brazil. Now comes the announcement that the company is preparing to embark on an iron-ore industry on a large scale. Nothing was said by the directors in their annual report or at the meeting of shareholders held last month, but in an inconspicuous corner at the end of Mr. George Chalmers' voluminous report, we find a paragraph that appears to us to be of prime importance. It is well known that the State of Minas Geraes, in which the mine is situated, contains enormous deposits of iron ore of pre-Cambrian age, and that both English and American ironmasters are giving close attention to them. The gold-bearing lodes worked by the St. John del Rey and Ouro Preto companies are found in these iron formations. The iron ore exists in a variety of forms and grades. On the surface it is mostly fragmental and of medium or low grade, while below the ore consists of laminated or massive hematite of the highest quality. The St. John del Rey company for the last few years has been quietly buying land adjoining the gold mine, and it now owns an unbroken estate of 140 square miles. Development was commenced on one deposit in January 1912, and already Mr. Chalmers is able to estimate the proved ore at 160,000,000 tons averaging as high as 67.3% iron with only 0.053% phosphorus. This is covered by fragmental surface ore, of a quality not quite so good. The hematite is soft enough to make mining easy, and at the

same time sufficiently hard to make timbering unnecessary in the underground workings. The cost of mining will be low, and the chief item of cost will be that of transport by rail and sea. The company has no intention of working the deposits in the immediate future, but intends to wait until the exhaustion of the high-grade ores of Spain and the United States creates an active demand for supplies from more remote parts of the world. In any case it would be impossible to exploit them at present owing to the scarcity of labour, which even prevents systematic development. The gold mine is suffering for the same reason and negotiations are in hand for the importation of labourers from Japan. Railway facilities will also have to be greatly improved. At present they are both insufficient and inefficient. Probably 10 years will elapse before much progress can be made. In the meantime the chances are that the gold mine will continue to provide dividends, for the ore reserves are equal to a four years' supply, and the lode is remarkably persistent at a depth of 4900 feet below adit.

The Old Masters.

Every once in a while it is advantageous to pause in the pursuit of new ideas, and consider our relative debts to current progress and to the work of the old masters. It is one of the editor's duties to inform himself concerning the past in order to interpret the present, and judging by the experience thus involved, we are free to confess that the majority of our readers do not give the old masters the credit they deserve. In the sphere of mining and metallurgy, as in all other branches of science and industry, a feverish desire to be considered up-to-date is prevalent. On the part of many this desire is merely a theatrical pose. These people quote the poet's words: "Let the dead past bury its dead." They consider a book-seller a cheat if he tries to sell them a work on copper-smelting or the cyanide process

that has been published for a longer period than a year. Unfortunately the preachments of these members of the profession are noisy, and their opinions and assertions reverberate to the confusion of learners and of those who have little opportunity of pursuing their own investigations. Another troublesome person is the philosopher fond of paradox, who says that the best state of mind for a successful investigator is a complete ignorance of what has been done or attempted before, because otherwise he will be discouraged by the failures of others and by the multitudinous ramifications of possible research. But this argument is shallow and insincere, if intended seriously, though from the more humorous and human point of view it may be admissible, especially when the investigator is in contact with the supercilious possessor of accurate knowledge of the past. The latter haughty individual runs the risk of unpopularity on account of his ability of saying "That has been done before," just as, when he has exhibited perspicacious foresight, he wins displeasure by his remark after the event: "I told you so." There is a wise medium between blank ignorance of the past and the overbearing advertisement of the superior wisdom.

Do not let us forsake the old masters and the old books that have stood the test of time. The chief reason for setting a value on them is the very fact that they have stood this test. The old masters constitute the survivors of previous generations. In their days plenty of worthless books and articles were published; these have suffered deserved neglect and have fallen into decay. Time has concentrated the current products in literature and art, as in the formation of placers and metallic lodes. The sculptures and paintings preserved at Florence were not necessarily average products of the age. They were the examples best worth preserving and the rest were allowed to share the fate of unconsidered failures. The old cements and mortars of Italy

are marvels of strength and permanence, but it is a mistake to suppose that such material was used for all buildings. Doubtless as much rubbish was used in those days; jerry-building was not unknown. The reason why ancient Roman mortars attract so much notice nowadays is that the poorer stuff of contemporaneous age has vanished before the ravages of the elements. In the same way the books of yesterday, having stood the test of time, are still reliable and continuously interesting to those who desire to be well informed.

Let us consider the main factors of present engineering and metallurgical progress. These are not so much based on new principles or on chemical reactions as on increased mechanical efficiency and on the reduction of the cost of operations, either by working on a larger scale, by using cheaper materials, or by the elimination of manual labour. In many cases metallurgical excellence is lower now than fifty years ago, but as against the sacrifice of quality there is to be reckoned the cheap production on a large scale that has immensely helped in the development of the world and the rapid spread of civilization. The crucible steel and the puddled iron of sixty years ago was of higher quality than Bessemer steel, but it was the introduction of the latter that made it possible to so greatly extend the railway systems of the world, and it was the subsequent development of the open-hearth process that laid the foundation of steel shipbuilding and the structural-steel industry.

In the domain of engineering, one of the chief factors in progress is based on the economy in the production and employment of power. The locomotive of 1845 was capable of carrying a train on the Great Western railway at as high a speed as is attained or desirable at the present time, and the improvement in haulage that has been effected is chiefly in connection with larger loads. The horizontal steam-engines built fifty years ago were marvels of accurate construction, and

many are still at work, having run continuously with never a repair. But their efficiency was low and their fuel consumption was five times as great per horse-power as that of modern plant. Cheap power is one of the most important items in mining and metallurgical operations, and it is in many cases relatively of more importance than the increase in the percentage of extraction.

Thus it appears that modern improvements are due more to the better application of mechanical engineering than to new discoveries in chemistry or geology. The fundamental principles as expounded by the old masters remain the same. Even in economic geology, the science that is making great strides at present, the old masters still hold their own. In fact, it is the increasing spread of its application and of its appreciation by the engineer that constitutes the advance in its importance, rather than the discovery of any new principle during the last few years. That the geologists are faithful to their old masters is evidenced by the forthcoming publication of the Emmons volume. Some of our readers may consider that in writing the foregoing remarks we have allowed ourselves to unconsciously assume the attitude of the reactionary. To these we would say that we do not allow our enthusiastic hope for the future to becloud our admiration for the good things of the past.

Talisman.

At the annual meeting some nice things were said concerning the manager, Mr. Henry Stansfield. We have reason to believe that they were thoroughly merited. An engineer who has "a good nose for ore" is rare, and when a company has such a man to direct its mining operations it is exceptionally fortunate. Nowadays we hear a lot about reduction of cost and improvement of treatment, but skill in either of these directions is vain unless sufficient material—namely, ore—is found for the exercise of such skill. Evidently the

Talisman is in luck in other respects. While paying handsome dividends on a precarious margin of ore reserve, it has had the repeated good luck to uncover more ore whenever the reserve seemed in danger of exhaustion. A hand-to-mouth policy is in accord with colonial traditions and does not suit the exigencies of London joint-stock finance, but we confess that the local directors have made good, not only in backing their policy by increasing their share-holding but by giving results satisfactory to the British proprietary. One of the local board, Mr. T. S. Weston, made a speech at the meeting, describing the recent exploratory work and the future prospects. It reads to us like the speaking of a man who understands mining, which is a qualification exceptional to the directors of mining companies. At the present time with 47,653 tons of £6 ore to be extracted at a total cost (including, of course, taxes and depreciation) of £3, the profit assured may be estimated at £143,000, or a little more than one year's dividend. Against this we have 345,000 shares at £1 each, quoted at £2, making a market valuation of £790,000. On such a basis we advise British shareholders to sell their holding to the gentlemen in New Zealand; and this is said without prejudice to the management, which is excellent. It is true, more than once the reserve has dwindled to one year's supply of ore, and yet the mine has not come to an end; but the repetition of such a performance becomes less likely as the resources of the mine become further depleted. A mine is a wasting asset. The widow's cruse of oil may be replenished, but it remains inadvisable to count upon miracles as a legitimate factor in mining finance. To expect the improbable to become habitual is against the canons of experience. A gold mine is an unwise speculation on the basis of an assured return of 20% of the capital. Risks are inherent in metal mining, but to risk 80% of your capital, plus all the interest due on that capital, is not sagacious.

ROYAL SCHOOL OF MINES

Henceforth a page in each issue of this magazine will be devoted to the affairs of the Royal School of Mines.

The recent dinner of old students was a real success, not merely as an example of convivial gastronomy, but as the beginning of a new departure. After dining together annually for 40 years in succession, it was suggested that an alumni association, or students' organization, should be formed. The suggestion of the Hon. Secretary (T. A. Rickard) was submitted subsequently to the committee, which endorsed it cordially. Thereupon a sub-committee was selected to prepare a scheme of organization. This having been accepted at a further session of the general committee, it was resolved to call a public meeting of old students. This meeting will be held in one of the rooms of the Mining and Metallurgical Club, at 2.30 p.m., on July 22. The chair will be taken by Mr. William Gowland, F.R.S., Professor Emeritus. All former R.S.M. students are urged to be present.

Old Students' Association.—Everyone who has been a student at the School for not less than one year is eligible. The objects of the association are to foster the comradeship, to advance the interests, and to express the opinion of the old students of the Royal School of Mines. The subscription is 10s. 6d. per annum. Life-membership is accorded to donors of £25 or more. Several have already become life-members, in order to give the association a good start. One of the purposes of raising funds is to be able to continue the good work started by the late Arthur Claudet, who set aside a sum for assisting students needing money to cover the expense of travelling to mines under the terms of a post-graduate scholarship. Old students are requested to send the names and addresses of themselves

and of R.S.M. comrades to the Hon. Secretary at 819, Salisbury House. Those who feel inclined to join the association on the preliminary information already given are cordially invited to do so forthwith, so that the movement may gather an early momentum.

Coaching.—A good deal of feeling has been created at South Kensington by reason of the realization that the coaching of students by junior instructors has developed to a dangerous degree. Obviously, if students cannot qualify for examination it is due either to their incapacity or to that of their teachers. If the first, then the students had better abandon the idea of entering the mining and metallurgical professions; if the second, then the authorities should select better demonstrators, or more of them. Coaching by junior members of the staff is a practice that lends itself to a kind of procedure likely to undermine that sense of honour which it is the first duty of a teacher to inculcate.

New Professor.—It has not proved easy to select a professor of metallurgy to succeed Mr. W. A. Carlyle, who, much to the regret of the School, has resigned. Fourteen names were submitted, and four were seriously considered. The selection will be announced officially soon after we go to press. In our next issue we shall be in a position to give full particulars.

New Buildings.—The new quarters on Prince Consort road are not yet complete, and we hear complaint concerning the delay. They were supposed to have been ready for use last October, but it is doubtful now if they will be entirely available next October. Old students who have not been to South Kensington during recent years should take the opportunity of visiting the new college buildings, and of lunching at the Students' Union.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

LIMA.

Copper.—The production of Peru for 1912 has been estimated by Aron Hirsch & Sohn at 27,400 metric tons, of which the Cerro de Pasco Co's. blister copper amounted to 20,400 metric tons, or nearly 70% of the total. It is of interest to note that including the Backus & Johnston Co's. output, these two smelters account for 24,535 metric tons of copper exported, or 90% of the country's output.

The Cerro de Pasco Co's. new 12,000 h.p. hydro-electric plant is nearing completion, and once installed will greatly enhance the company's operations. The 17 kilometre combined ditch and pipe-line is practically finished and will furnish a minimum of 200 second-feet of water with an effective fall of 750 ft. Six Pelton wheels will be connected, in sets of two, with three dynamos, each of 3000 kw. The transmission line will extend to the power-plants at the smelter and Cerro de Pasco (over 70 miles distant from the power-station), also to the Morococha Mining Co., in Morococha (less than 15 miles distant). Rumour states the Cerro de Pasco railway will be electrified. It is hoped that the hydro-electric plant will be in operation before the close of the year. The entire cost of the installation, including the transmission line, is stated to be over \$1,000,000. The intake-site has been so chosen as to involve no expensive dam construction. The adoption of electricity to replace steam will divert the coal, now being used under the boilers, to the coke-plant, thus enabling the company to be assured of its coke supply and be independent of foreign coke, which increases the smelting cost. The coal mines of Quishuarcancha are to become active producers now that the railroad has been completed. The monthly production of blister copper continues to be near 4,000,000 pounds, but a higher output is expected. With the recent change of administration, W. J. Hamilton having been appointed general manager, the headquarters of the company have been transferred to the smelter. The Lima office is being continued, but it will be of less importance than heretofore.

The Morococha Mining Co. has commenced operations, shipping upward of 7000 tons of ore monthly to the Cerro de Pasco smelter.

The monthly output is stated to be 10,000 tons, so that the surplus extracted is being stored. Lack of transport facilities has prevented an increased production, but such a condition will be relieved in the near future. Surveys are now in hand for a branch line to connect with the Cerro de Pasco railway at some point between Oroya and the smelter, thus ensuring a more rapid, as well as independent, outlet for the ore and permitting of increased production. The cost of this branch line is not expected to be excessive, while the advantages accruing are evident. It seems as though the company will eventually control most of the output from Morococha through its own mines and the custom business it may develop. The cross-cut adit, Carlos Reynaldo, which is headed for the San Francisco mine, is in about 1500 ft. (not quite 40% of the total length to be driven), the advance being slow because of an inefficient air-compressor. New drills and a compressor plant are expected to be installed soon.

The Natividad mine, owned in equal shares by the Morococha Mining Co. and the Backus & Johnston Co., has been pumped dry, after being drowned for several months. The lowest level (No. 5) had just been started when trouble was experienced with the old pipe-line and the pumping plant. The new lead-lined discharge pipe-line and the new bronze-lined pumping plant, of sufficient capacity for emergencies against unexpected flows of water that may be encountered in developing the No. 5 level, have already proved to be serviceable and efficient. The ore is of a desirable quality for smelting at Casapalca, and it is expected that shipments of 1500 tons per month will be made shortly to that smelter. The Backus & Johnston Co. also controls the output of the Victoria, Alapampa, and Churruca mines. The Morococha Mining Co. has bought the 50% share of the Gertrudis mine, thus gaining full ownership. The Morococha district will undoubtedly become an important factor in the copper and silver production of Peru.

At Casapalca, the Backus & Johnston smelter is rapidly approaching the completion of its enlargement and improvement. The new 160 by 52 in. furnace has not yet been blown in. The new chimney is erected and

in operation, and the converters are being erected. The hydro-electric power-plant, of 2000 h.p. capacity, to be completed within a few months, will ensure the operations of the converters and new furnace, enabling the plant to smelt probably 16,000 tons of ore per month—raw and sintered products—as against 8000 tons at present. The company is also erecting a 1300 m. aerial ropeway, having a capacity of 25 tons per hour, to bring down ore from several dumps to the smelter. It is of more than passing interest to mention the sudden death of J. Howard Johnston, one of the founders and the largest shareholder of the Backus & Johnston Co. Due to his untiring energy, foresight, and ability, the company was rescued from apparent bankruptcy. Mr. Johnston applied himself entirely to the reconstruction of the smelter and re-organization of the business, spending four years at Casapalca, at 13,600 ft. above sea-level, without visiting the coast to recuperate from the physical effects of the high altitude. A severe attack of heart trouble caused his hurried descent to Lima, but three days later he succumbed. He had almost reached the goal of his efforts, and had seen the good effects wrought by his changes. Several months ago the company made a £100,000 bond (8%) issue, of which W. R. Grace & Co. took £50,000, to pay off the indebtedness to Duncan Fox & Co. The company's production for 1912 was 9,600,000 pounds of copper in the form of matte and ore.

In the newer copper districts no improvements of conditions have occurred. The Sayapulco company is still negotiating for the sale of its properties to a French syndicate; meanwhile several changes have been made in the local management. At present the 30-ton water-jacket furnace is in operation; the matte shipped has given sufficient profit to enable the company to pay some old debts. The prospecting work of the Cobriza copper claims, in the province of Tayacaja, has been discontinued; all the material has been sold.

The French syndicate that purchased the copper properties known as Sociedad Cuivre de Huaron, near Haiday, 35 miles from Cerro de Pasco, has recently installed a 30-drill compressor. The development of the Travieso and other veins is being actively carried on, but no shipments will be made for the present until the property has been more developed.

Gold.—The result of further prospecting on the claims of the Ambo mines, two days horseback ride from Cerro de Pasco, is said to have proved a wonderful gold deposit. The

ground is said to average \$6 per cubic yard, as sampled by test-pits and tunnels, but the choice of method has not been made, that is, whether dredging or amalgamation and cyaniding. The property is now being examined, and may be drilled, for the account of the Haggin interest, which has purchased the control of the syndicate formed after the purchase from the original locators. Without railroad facilities the value of the property is doubtful, but it is probable that the Ucayali railroad will be continued from Goyllarisquisga. Another supposed Eldorado is being prospected in the Sandia district, in southern Peru. A party of Alaskan prospectors is now on the ground. This region is not far from the properties of the Aporoma Goldfields, Ltd., which appears to have obtained a sufficient water-supply, although it has not attained as yet either the capacity (5000 cu. yd. per day) or the gold contents (10 pence per cu. yd.) originally anticipated. The New Chuquitambo Gold Mines, Ltd., has met with a setback in operating its new cyanide plant to handle the low-grade tailing. The small amount of copper present (said to be "only decimals") caused considerable consumption of cyanide, prohibiting economic treatment. The development of the deposit has resulted in encountering much water, necessitating a pumping-plant. The 40-stamp mill, which extracts 65% to 70% of the gold by amalgamation, continues in operation. In the Pataz region, inside from Chimbote, the options on several properties are said to have been exercised by the Pataz-Pareoy syndicate; about 100 men are at work, at present, on the various gold veins. The gold production of Peru is still an unimportant amount, if allowance be made for the gold contents of the copper products exported. Perhaps these renewed activities will change matters.

Oil.—With the world-wide interest for oil that now exists, attention is being given to possibilities in Peru. The production for 1912 is estimated to have been 1,750,000 barrels (approximately 250,000 metric tons), an increase of nearly 3,000,000 bbl. over 1911. There are four operating and producing companies; while one local syndicate is drilling in apparently favourable ground and another will start soon. The oil industry is confined to the northern part of the country beginning at the Ecuadorian boundary and extending to north of Paita, the most important sea-port in northern Peru. There are several stretches on the coast that appear to warrant drilling, and negotiations are under way with this ob-

ject in view. The oil region in the southern part of the country, around Lake Titicaca, has apparently been abandoned. In 1910 a decree prohibiting the denouncement of oil ground was issued for political reasons; efforts are now being made to have the decree repealed so as to encourage foreign capital to explore promising areas.

Railroads.—Considerable attention has been given to the Amazon & Pacific railroad, known as the Ucayali railroad. The president refuses to recognize the transfer of the concessionaire—A. W. McCune—to the capitalists. Meantime work has stopped. The

freight. The usual amount of 'slides' which are frequent only during the rainy season has increased the crippling of transport. In consequence, up-freight has accumulated in Callao while mineral and copper products are stacked on the line. The new rolling-stock is not yet in use and the old has become seriously depleted. The call for increased wages by the strikers has been reflected in the higher cost of living, due to the congestion of freight, which also meant food-products for the coast.

Nitrate.—Months of exploration in the department of Arequipa have proved the depo-



THE ANDES AS SEEN BEHIND SANTIAGO.

road begins at Goyllarisquisga, at which point the coal mines of the Cerro de Pasco company are situated, and descends to the Huallaga river, Pucalpa, on the Ucayali river, being the terminus. In all probability part of the road will be built, as has already been stated. If the £5,700,000 loan, now being negotiated in Europe, is realized, there will be considerable railroad construction affecting the Chimbote-Recuay railroad, also the Chilite-Magdalena and Retama-Izcuchaca continuations. These lines will encourage mineral development in the regions traversed. Due to the prolonged strike in the machine-shops of the Central Railroad of Peru, close to Lima, the rolling-stock has suffered from delays and serious accidents in handling the accumulated

sits to lack economic value; all work has been discontinued and the region abandoned.

Zinc.—The option, held jointly by the Mineral Separation Co. and Aron Hirsch & Sohn, on the famous Carahuacra property, has been allowed to lapse after considerable negotiating had been done. It is now stated that an American syndicate is arranging for an option to investigate the zinc possibilities of the property. Some attention is being directed to zinc, and small shipments are being made. Lack of transport—and high cost of it—makes the net return on zinc ores, unless carrying silver, an unattractive proposition. The fall in the price of zinc will also tend to discourage activity in this direction.

MELBOURNE.

Labour Troubles.—The strike at Broken Hill was of such a nature as to attract the attention of every thinking man in Australia. Coming just before the election for the Federal House it ought to be an object lesson of what may happen when the leaders of labour really feel their strength. Allusion has been made at length in these columns previously to the advance in the militant tactics of the unionists of Australia, but no precedent could be cited for the line of conduct laid down by the Barrier unions. The labour leaders have been slowly maturing their policy of coercion. When the last strike occurred, a few years ago, they put in force the boycott. Every tradesman in the place was made to realize that, should he, when further disturbances occurred, side with those who were opposed to the unions, or even extend kindness to the men who might act passively, he would be marked down for punishment. The next step of the unions was to weld together the whole of the labour of the Barrier into one organization. This has been done slowly, but surely. Therefore, today the sight is presented of a mining centre of the first importance recognizing the law of the union leader.

There had been plenty of signs that trouble was impending, but it was expected that the dispute would be in the mines and over the non-unionist issue. But the managements apparently did not wish to put on the gloves, and so the decision of the labour-leaders that men must show their pence cards had not then been openly challenged. It seemed, indeed, as if the year 1913 would pass without trouble. The Silverton Tramway Co., which provides the means of transport from the South Australian border to the field, by linking its line with the State railway system, had a score or so of clerks in its employ. The labour councils decided to compel the whole of these men to join the clerks' unions and to affiliate with the Trades Hall. The law of the State does not permit employers to forbid the organization of a union, but it does allow an employer to say that men who occupy confidential positions cannot be coerced. This issue was immediately raised by the directors, and, on the unions declining to give way, the strike was begun. The whole of the men affected would have joined the clerks' union, but the directors insisted that seven should remain loyal to them. Yet over these few the population of 30,000 people at the Barrier and the huge mining interests of that district were thrown into chaos. The town was cut off

from food, and the mines from supplies. In the midst of this trouble, the leaders had the impudence to declare that the strike was no strike, but a lock-out! The reason of this is obvious. Under the New South Wales laws, the people who cause a strike can be mulcted in a penalty of £1000, and it was most convenient that some excuse should be provided for evading that fine. Mine after mine had to be closed and people were put to great personal distress. In the end, there was no help for the men except to yield. The district is so isolated that with the railway service at a standstill there could be no relief except by getting the railway at work again. To ensure that, the New South Wales government was called upon to repeat the action it had taken in Sydney over the ferries strike: to seize the line and rolling-stock, using these for the conveyance of food and supplies. But the State had no right to do anything of the kind. It could buy the company out, but it could not trespass. The Labour government at Sydney saw its inability to aid labour rule at Broken Hill, and tried to do a magnificent wriggle. It asked the government of South Australia if it would lend its rolling-stock for use on the company's line. The reply came in the form of a question. It was whether the New South Wales government had obtained the permission of the Silverton Tramway Co. to use the line. Of course, leave had not been obtained. So, as the Labour government could do nothing, and as the Silverton Tramway Co. let the strike go ahead without resistance, the mass of the working population of the Barrier realized that they were being led by asses. A way of escape was suggested when it was proposed that the question of the Tramway company retaining its employees should be referred to a board. This was done and within three weeks the strike fizzled out. The mines have lost very little, as it happens, but that is not the fault of labour.

The mines were not slack in perceiving that the failure of the attack on the Silverton Tramway Co. provided them with the opportunity to hit the unions. So, after a resolution had been carried by the labour federation insisting that pence cards should be inspected on the mines on May 1, they announced that they would not permit such a thing. The extremists who had led in a struggle with the Tramway company sought to force a fight, but the moderates were disinclined to support them, and when one of their number moved that the inspection be not insisted on at present, the majority of the men at a mass meet-

ing carried the resolution. Consequently all fear of immediate trouble is now at an end, though it must not be imagined that labour intends to sit quiet. It was time that the companies provided a stiff back. The next thing they would have been required to do would have been to take on men in the order set out by the unions. This would have meant that inefficients would have been drafted with the efficients, or the independent workers could have been kept in the background. As it is, the mines generally complain that they get neither efficiency nor consideration from the workers, but as labour is scarce they hardly

which they are faced in the handling of complex ores is widening the experience of the technical men at Broken Hill, and making that place the headquarters for a special class of investigation. One effect of the work done must be to render the life of the purely process company somewhat precarious. No earthly reason can exist why the big concerns at the Barrier shall not treat their own zinc tailings and slimes, instead of letting someone else do it. Most of the mines jog along quietly. The report of Block 10 company shows that only a shade over 200,000 tons of ore remains in the mine. All the boring done



THE DE BAVAY FLOTATION PLANT AT BROKEN HILL.

dare whisper their discontent for fear that they will be involved in a dispute. As it happened, circumstances enabled them to give the unions a fall, but the latter will soon be on their feet again, determined to do mischief. Should the Federal elections go in favour of Labour then the party may be emboldened to adopt tactics that will try the patience of even the most complacent London director of a Broken Hill company.

Broken Hill.—Affairs progress apace. Experiments with the flotation process attract most attention, the aim being to deal with the slime from the lead mills more effectively than is the case at present. In most instances, secrecy is observed as to what results are being attained, but that progress is being made is certain. Moreover, the appeals of metallurgists in other districts to the men at the Barrier to help them solve problems with

at 1815 ft. and below that point tells that the keel of the ore-shoot has been reached. The mine has a life of about $2\frac{1}{2}$ years, should the present output be maintained. As the company has a fairly big nest-egg of cash it may buy another mine, but it will venture a great deal before it alights on such a bonanza as its own claim.

Copper.—The chief item of interest in connection with copper mining is the purchase, by Lionel Robinson, Clark & Co. and their followers, of a block of over 300,000 Mount Morgan shares belonging to the Hall estate. The transaction represents about a million sterling, as £3 per share is being paid for the scrip, but of course, payments are on the deferred principle, and the return from the mine is more than the interest to be paid on any sum outstanding. To the mining man the question arises whether the position of affairs

justifies the deal. In this connection it may be pointed out that the company is spending a large sum in putting up a fresh nest of smelters of the most modern design. A large reduction in cost is expected to ensue when this plant is in blast, and important economies are also being effected in other departments. By these means, the dividend may be raised from its present figure of 4s. to 6s., or even more per annum, and as the resources of the property are great the purchase of the shares from an investment standpoint may be regarded as satisfactory at the figure given. As the price of shares moves upward this statement may have to be modified, unless developments keep pace with the market addition to the valuation. However, it is understood that the purchasers prefaced the proposal by getting several independent reports on the Mount Morgan mine, including that of Mr. George Weir, of the North Broken Hill. Mr. W. L. Baillieu is to join the board of the company. If it be true that special reports have been made, it is a pity that they cannot be available to shareholders.

Other copper interests in Northern Queensland are quiet. Developments at the Hampden mine are as usual, but at the Duchess most encouraging results have been obtained in the winze below the 550-ft. level. Every effort is being made to push ahead with work at the Hampden South Consols, so as to be able to operate outside the fire region and resume the delivery of ore to the Mount Elliott mine. At that property development operations are in full swing, so that there shall be ample supplies of that ore to flux with the Hampden South Consols, when the latter is available. In New South Wales the Great Cobar management has to face the upset occasioned by the market collapse in London and Paris. Generally the belief is that the output is likely to drop, and that the flotation process is not answering so well as was expected. There also has been news of a creep in the mine, but this assertion lacks confirmation.

Silver and Tin.—Much interest has been taken in the statement that Bewick, Moreing & Co. have decided to take on the task of re-opening the Sunny Corner mine, situated some little distance from Sydney. This is a silver-lead-zinc property that has stood idle for a couple of decades. Excitement has run high in respect to the Ardlethan tin district. This lies west from Sydney, and some high-grade ore has been found. So far, too little work has been done to indicate the size of the

ore-shoots, or their persistence. Still, that has not prevented wild share-gambling, and some mad flotations. One company promoted was not given any working capital; that was furnished by the vendors. Even then it was a mere fraction of the total capitalization of the concern.

SAN FRANCISCO.

Yukon Gold will be remembered as having been the vehicle for one of Thomas Lawson's theatrical performances. It was over-boomed and there was a severe reaction, from which the stock never recovered. The property, however, is excellent, and has been well handled, having been under the capable technical direction of O. B. Perry, who left San Francisco early in June for the season in the Yukon. In the report for the year 1912, recently distributed, Mr. Perry states that the eight dredges at Dawson began operations in the first week of May and worked until October 24, when failure of the Granville Power Co. to furnish power forced suspension for the winter. The length of the season was 172 days and the dredges operated 86.15% of the possible time. The yardage was 5,157,280, which yielded \$3,246,026, an average of 64.88 c. per cu. yd. The cost was 30.64 c. per cu. yd. Of the area mined 73.58% was frozen and had to be thawed. The engineers, by the way, have devoted much time and study to thawing and have discovered many interesting facts. The ground thaws better under the 'muck' or vegetal overburden, because the latter acts as a blanket to retain the steam; proper spacing of the steam-points is of great importance to secure the minimum of overlap; it is better not to dredge immediately after thawing, since, while the 'points' only stay in the ground 48 to 72 hours, heat continues to radiate for days. Other technical problems are being studied with equal care and as a result of improved practice and an additional new dredge, there was an increase of 1,000,000 yards in the amount mined in 1912 as compared with 1911. The No. 7 dredge, having finished its work on Hunker creek, was transferred to Iditarod and re-erected there. It began operation on August 15, and continued till October 29, mining 172,333 cu. yd., with a yield of \$404,040, equal to a yield of \$2.34 per cu. yd. at a cost of 45.91 c. As the work began late, and the expense, accordingly, was high, this speaks well for the future. The hydraulic operations at Dawson resulted in the mining of 2,967,750 cu. yd., with a yield of \$629,043. The cost

was 9'37 c. per yard, a decrease of 6'13 c. as compared with 1911. This was due to better water conditions and lower cost for ditch maintenance and operation. The total production for the season amounted to \$4,863,448, and the costs \$2,142,029. The new Iditarod properties, being operated on lease, will add to the total profit without increasing the capital expenditure, and since the report was distributed it has been announced that the company has acquired dredging land along the American river in California and will at once build a 7½-ft. Bucyrus dredge for work there. Options on additional land are held and drill-



Shasta County, California.

crews are at work, so it is not improbable that more dredges will be needed. Yukon Gold is, seemingly, to be the dredging company of the Guggenheim enterprises and the new developments certainly improve the outlook for the stockholders.

Gold Fields money, mainly through the Gold Fields American Development Co., Ltd., has come to be largely interested in American enterprises. Among concerns in which the Consolidated Gold Fields of South Africa and its clientele have interests are Natomas Consolidated of California, Oroville Dredging, Ltd., Sierra Pacific Electric Co., Mississippi Power Co., Yuba Con. Gold Fields, Granville Mining, Vera Cruz Mexican Oil, and other well known enterprises. As will be noted, these investments are by no means all in mining. The Mississippi Power Co., for example, is a hydro-electric concern engaged

in developing 300,000 hp. by damming the Mississippi at Keokuk, Iowa, in the heart of the industrial region of the United States. This company is about to begin delivery of power at St. Louis, Missouri, and it is reported that the price to the local distributing company is to be \$28 per hp. per year. As St. Louis has long been famous for the low cost of fuel, steam-coal selling for 80 c. per ton, it will be seen that only a large-scale hydro-electric project could hope to succeed. The Gold Fields group has not, however, turned its back on mining, and in two directions has recently taken new holdings. Of these the La Grange hydraulic mine in Trinity county, California, is best known. The La Grange is the largest mine of its kind in the world and one of the few that continue in operation in California. It discharges annually several million cubic yards of tailing, but as these go into the Trinity river, which is not part of any system of navigable waters, and as the company owns the land covered by the tailing, there is no trouble. The ordinary working season is from November to September. An extensive series of flumes and ditches has been built. It is estimated that the water-power available when the mine is worked-out will be over 17,000 hp. In the meantime it is used for washing gravel, which contains from 1 c. to 25 c. per yard and averages about 3 c. The deposit is an old channel crossing the divide from Weaver creek to Oregon gulch. The bank is about 450 ft. high and there is an enormous reserve. The mine has been under the management of Pierre Bouery for some years and control has been in the hands of Mr. Bouery, D. M. Riordan, and the late Robert Mather, sometime president of the Rock Island railroad system. The Gold Fields first became interested in an option to buy the property and later bought the stock of the existing La Grange Mining Co., subject, of course, to the option. If the latter is exercised in July, the Gold Fields will have a minority interest. If it fails, as seems probable, it will have the whole property. The option price is said to have been \$550,000. There is some dispute over the transaction, but it seems probable that in any event the Gold Fields will be able to hold possession.

Potash forms the basis of the second important expansion of the Gold Fields holdings. The deposits consist of brine in Searles lake, California. This saline deposit was found many years ago, though the fact that the brine contains potash is of recent discovery. The marsh along the edge was worked for borax

for many years, and adjacent lands, with the old borax works, are still the property of the Pacific Coast Borax Co., one of the companies dominated by F. M. Smith, whose financial affairs are now in the hands of a reorganizing committee. When the colemanite veins of Inyo county were developed the old deposits became unprofitable, and operations at Searles lake ceased. Later the California Trona Co. was organized to mine and market the soda-ash deposits of the lake, and to this concern the Foreign Mines Development Co., in which Gold Fields is interested, loaned \$50,000. The Trona company failed and the Foreign Mines Development Co. got possession through receivership proceedings and also through purchase of the stock of the original Trona company. Various efforts were made to sell the property and among others F. S. Pearson at one time had an option, and for him Smith Emery & Co. investigated the project. One of his engineers discovered the presence of potash and this discovery was verified by Smith Emery & Co., and later by E. E. Free and H. S. Gale, the two latter acting for the U.S. Department of Agriculture and the U.S. Geological Survey respectively. Mr. Pearson's Mexican interests required his attention and the option was not exercised, whereupon Guy Wilkinson, acting for the Foreign Mines Development Co., arranged to work the property rather than to sell it. The announcement was made early in June that the American Trona Co. had been formed to control and manufacture for the California Trona Co. The new concern will be capitalized for \$12,500,000, of which \$5,000,000 is to be represented by preferred 7% stock protected by a sinking fund and redeemable after July 1, 1916, at 110. The new capital going into the enterprise is stated to be American, but the Gold Fields group will naturally have a large interest. A railway and new works are to be built immediately at a cost of \$3,000,000. The works are to treat 2,000,000 gal. of brine per day and from this will be obtained 225 tons of borax; 508 of soda-ash; 1507 of salt; 593 of sodium sulphate; and 489 of potassium chloride. The salt and sulphate will, for the present at least, be practically waste products. The potash is to be sold to fertilizer companies in the Middle West, the soda-ash is to be marketed mainly in the Orient, and the borax will come upon the general market. As the amount of borax produced determines the amount of potash and soda-ash, and the distribution of cost is a matter of book-keeping only, the new concern will

have every inducement to increase consumption by lowering prices. This has created an uneasy feeling among local holders of borax securities, but it is stated that the policy of the new concern will be to be "manufacturers for manufacturers" rather than general distributors.

JOHANNESBURG.

Tin mining is not making the rapid progress that optimists predicted last year. In 1911 the Union of South Africa shipped 3373 tons of concentrate, equal to 3.1% of the world's output, having a value of £395,472. In 1912 the figures were 2726 tons, 2.4%, and £338,897. Dividends amounted to £163,250 in 1911 and £108,700 in 1912. Turning to the present year, returns for the first four months show that 1071 tons of concentrate have been sold for £146,458, and from this and recent encouraging developments it may be fairly assumed that the output for the current year will exceed that of any previous year. The tin region of the Transvaal, which produces practically all the concentrate exported, begins about 60 miles northwest of Pretoria and follows for 100 miles in a northeasterly direction a belt of country containing the contact of the red granite with the Lower Waterberg system. The tin deposits occur in the red granite, in felsite, in shale, and in a pink feldspathic quartzite or arkose, but never more than five miles away from the granite margin, and usually either at or close to it. The orebodies are extremely varied in form and constitution. In the Zaaipplaats mine, for instance, the ore is found in coarse red granite in roughly cylindrical pipes about 7 or 8 ft. in diameter and in irregular lenses and fissures associated with or branching therefrom. This ore is rich and pure, and assays of from 30 to 50% metallic tin are not at all uncommon. In the Rooiberg mine the orebodies lie in the Rooiberg quartzite or arkose, and the several sets of lodes crossing each other give rise to what may be compared to a stockwork on an exaggerated scale; and these lodes are supplemented by branch fillings and pockets along the bedding planes of the arkose. The Leeuwpoort mine is in the same country-rock, and there are six different types of deposit being developed on the one property. Although only 15 miles from Rooiberg, its ore is of quite a different nature and contains very little tourmaline, the usual dominant constituent, but a large proportion of iron. In the Waterberg district the ore deposit may take the form of cylindrical pipe,

dissemination, impregnation along lines of fissure, lode, stockwork, pocket, small vein, and, rarely, alluvium. Generally speaking, the deposits are erratic as regards continuity, and patchy as regards tin contents, and none of them have been yet proved to any decisive vertical depth. But although a large element of uncertainty goes hand in hand with tin mining in the Transvaal, the present high price of the metal and the richness of some of the ores make many of these propositions very attractive. In May the Zaaiploats mine crushed 3250 tons, re-treated 1027 tons of residue, recovered 112 tons of concentrate, and made a working profit of £10,397. This company liquidated its liability at the end of March, and with development turning out well, it is just now in a strong position. The Rooiberg company in May crushed 2961 tons, recovered 103 tons of concentrate, and made a working profit of £6,802. These two mines are the chief producers. The reduction plants vary like the geology. Welgevonden, a new producer, which is just about to start, has 10 stamps of 1250 lb., 4 Wilfley tables, 1 tube-mill, 5 Isbell vanners, 2 Cornish round frames, 1 Acme table, 2 buddles, Callow tanks, and classifiers, &c. The ore reserve of this property is 19,200 mill tons, averaging 2.55% tin. The Rooiberg plant and flow is briefly as follows: From 10 stamps of 2000 lb. with 8-mesh screening the pulp goes to a Callow screen of 20 mesh, thence coarse to Hartz jigs, jig heading to Brunton calciner, middling and tailing to tube-mill. Underflow from Callow screen to classifiers and 6 Wilfley tables, overflow to slime-plant. Wilfley heading to calciner, middling to tube-mill; tube-mill product to another 6 Wilfleys and slime-plant; heading to calciner, middling to 5 Frue vanners. Slime to three sets each of 14 rag frames, then to 6 revolving tables and 2 Acme tables. Dolly tubs, buddles, magnetic separators, &c., complete a really first-class equipment. The ore reserve of this company is 151,500 tons, averaging from 3.5 to 4% tin. Leeuwpoot is to start crushing in August with a dressing-plant capable of treating 4500 tons per month, and it is expected to reach the position of premier producer by the end of the year. Its ore reserve is 91,656 mill tons, estimated as 2.4% tin. With several new mines about to start, improvements being made to the old, and the likelihood of tin maintaining its price for a year or two, the immediate outlook for the tin industry of the Transvaal is most encouraging. It is the beginning of a base-metal industry.

Diamond-Cutting Industry.—The Select Committee has now issued its finding. This takes the form of one majority, and two minority, reports. The majority report favours the establishment of a diamond-cutting industry, and advocates a 10% export tax on rough stones. The first minority report recommends further investigation of the financial aspect of the problem; it also recommends a tax of 2½% on exported rough stones, and the granting of bonuses to encourage the cutting industry. The second minority report expresses entire disapproval of the idea. The main objection seems to be the high cost of living, which, it is feared, would raise the expense of cutting to a prohibitive figure; other objections being, possible increase of illicit traffic, difficulty of getting the right workmen, and greater difficulty of selling the finished stones. The controllers of the diamond output are, of course, quite opposed to the idea, as they fear losing their grip on the market. Some interesting evidence was given by experts during the inquiry. It was shown that if stones are bought judiciously there is a profit of 50% to be made on cutting. The cost of cutting a 2½ carat stone at Cape Town would be:

Price of rough stone.....	£21	5	0
Cutting and polishing.....	4	5	0

Cost of finished stone....£25 10 0

The result would be a one-carat stone worth £30 in London. The cost of cutting as given is twice the cost at Amsterdam, the average wage there being over £4 per week as against a probable £7 in Cape Town. An interesting fact brought forward was that an ordinary stone might require anything up to a week's study before it could be decided how best to cleave and cut it, and that the Cullinan diamond, presented to King Edward, required three months' scrutiny and cogitation by Messrs. Ascher & Co. before they dared attempt its division. When their decision was made, it took only a few to divide up the largest diamond that the world has ever seen. The statistics of diamond production show that the Union of South Africa produces annually stones to the value of £10,000,000, German South-West Africa, £2,500,000, and Australia and Brazil together £250,000; and that in the last 20 years the price of diamonds has risen 100%. The main reason for this rise is the advent of the new-rich American. This product of hustle lives to demonstrate his wealth to his envious friends, and by doing it with diamonds he both impresses them and

ensures domestic peace. The outcome of the reports will most likely be the shelving of the question till the Government feels more confidence in its power to tackle it.

Annual Reports of companies have been streaming through the post lately. A cursory perusal of these documents suffices to show that the Rand has a great deal to learn yet with regard to the quantity of information to be given to shareholders and how best to give it. Ore reserves are stated on stoping, milling, and recovery bases, according to the predilection of the compiler, and apparently without much thought as to the basis that most commends itself to the investing public. The ore reserve of a mine being a vital asset, it is time that some standard practice should be adopted in its statistical presentation, and the method to be followed removed from the thrall of a fortuitous and inept faddism. The need for such uniformity is not so pressing on the Rand as it is in other more highly speculative mining countries, such as Rhodesia; but, for all that, in such an important matter the Rand might well act as the pioneer of technical lucidity. The balance-sheets again are models of beautiful accountancy, but Greek to the average shareholder. The directors are generally good enough to try and make the financial position easily comprehensible, or the chairman may be in a more communicative mood than usual and furnish a simple explanation in the course of his remarks. Failing such simplification and in the absence of an accountant friend, there is nothing for it but a splitting headache and an ice-pack. These are matters to which the Committee of Consulting Engineers and the Chamber of Mines might with profit devote a few minutes.

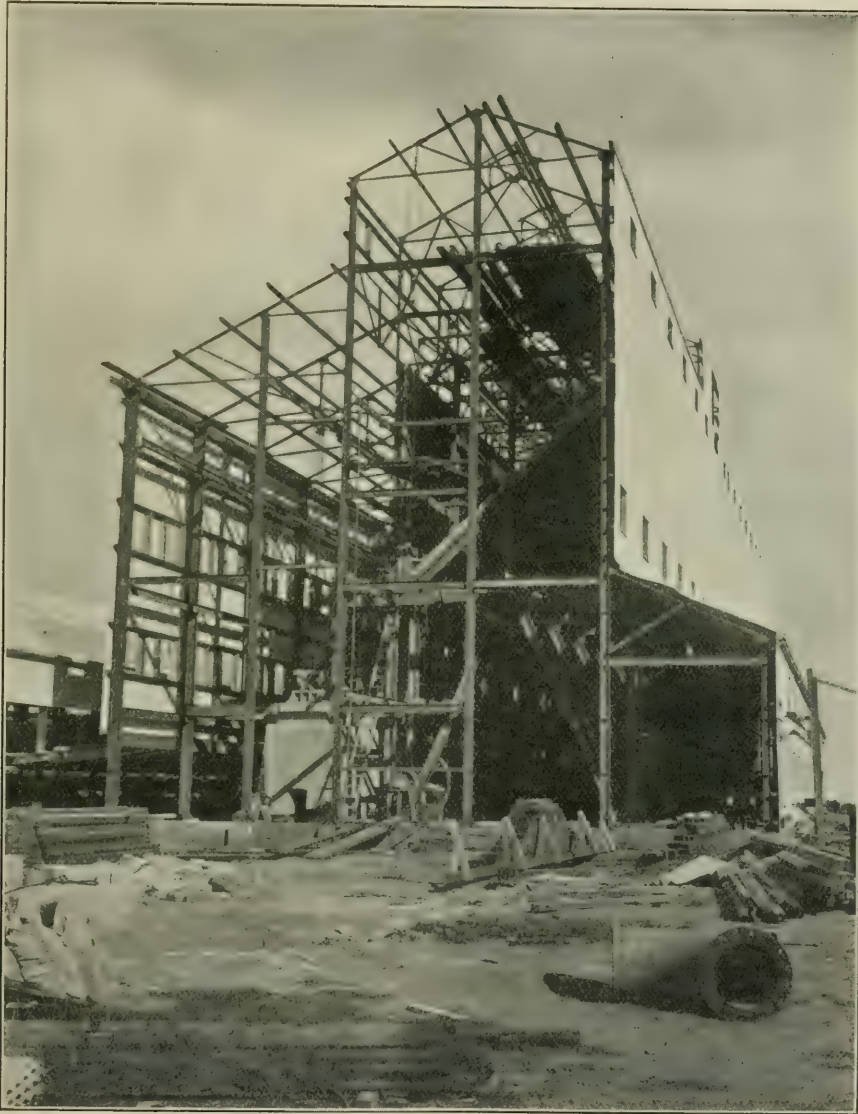
City and Suburban in 1912 made its best profit since the war. As compared with the previous year, the yield per ton rose from 7'14 dwt. to 8'78 dwt., an increase of 7s. 0½d., the working cost rose 2s. to 21s. 7'7d.; the profit rose 5s. 0½d. to 16s. 9'7d., and the total profit jumped from £174,004 to £278,418, which permitted raising of the dividend from 11½ to 15%. Contrary to expectations based on the improved yield, development ore shows a tendency to decrease in assay-value. In 1911 the average inch-dwt. for the footage sampled was 407, in 1912, 368, and in the March quarter, 335. In spite of this depreciation the ore reserve shows no tendency in the same direction, being now 773,300 stope-tons of 8'4 dwt., as against 789,084 tons of 7'5 dwt. at the end of 1911. On this showing the present yield should be maintained for the next two

years, but if development ore continues to become poorer the yield must eventually drop in sympathy. The company is just about to purchase 15 claims from the City Deep at a cost of £101,250. These claims will widen out the bottom of the mine, which now comes to a sharp point, and add nearly two years to the life of the property, making the life about seven years. Turning to the dividend prospects, we have as a guide the working profit for the March quarter, £65,845, which, allowing for sundry revenue, is equivalent to a total of £269,000 for the year. Adding to this the balance of liquid assets, £46,545, and deducting £25,000 (the first instalment in respect to the claim purchase), and assuming that, as in 1912, 73% of the profit is distributed, there should be sufficient for a 15% dividend. The capital of the company is £1,360,000 in 340,000 shares of £4 each, all issued. It is a steady-going concern, content to plod along as a regular dividend-payer and evincing no desire to indulge in record-breaking antics or to take part in amalgamation orgies. Its head-office is in Natal. The chairman, at the annual meeting, made the inevitable reference to phthisis in the following terms: "We have the excellent testimony of Dr. Van Niekerk, Adviser to the Native Affairs Department, that the conditions in the mines are improving rapidly, and that dust is being satisfactorily prevented and laid, and that in his opinion, phthisis would, in five years' time, be practically unknown." Unfortunately for the Rand such a happy state of things seems scarcely credible.

The Strike at the Kleinfontein mine, which commenced on May 26, still continues at the moment of writing. The cause of the dispute was an alteration in the working hours of five underground mechanics, pipe-fitters and so forth, whereby they were required to work the same number of 'face to face' hours as the miners. This alteration infringed no legislative enactment, but it was regarded by the men concerned and their co-workers as a high-handed attempt to deprive mechanics of part of their Saturday afternoon, and an innovation to be resisted at all costs. A ballot was, therefore, taken, and as a result of the counting all the miners, engine-drivers, mechanics, and even some of the reduction men, put on their coats and walked out, bringing work to a standstill. Pressure was then brought to bear on the directors, and they, seeing the inadvisability of risking so much to gain so little, issued a notice restoring the old hours, and offering to reinstate all employees who

returned to work by June 11. By this time, however, the professional agitators, who crop up like mushrooms when trouble is forward, had got to work and filled the air with the usual hot clap-trap, and thoroughly distorted

making for the acceptance of any olive-branch. Having thus put themselves in the wrong by striking without due notice and having alienated public opinion by refusing to entertain the friendly apology of the company, the men



MILL OF THE VAN RYN DEEP IN COURSE OF CONSTRUCTION.

all ideas of perspective in the minds of most of their listeners. Consequently, the men on strike, who were enjoying a holiday and being well paid for it out of strike funds, felt emboldened to ask anything, dictate anything, and fight anybody, a condition of mood not

have placed themselves and the leaders who advised them in a very muddy road. This position has been in no way relieved by the vagaries of the agitators, one of the most prominent of whom, to emphasize his contempt for constituted authority, declared pub-

licly that if King George came out to arbitrate he would be the first to break his neck. The strike may develop into a general one along the reef, but this is considered to be an unlikely contingency; and the situation as regards Kleinfontein now is that a large proportion of the strikers have slipped back quietly to work and volunteers are coming forward in such numbers that in a short time the mine will be fully manned again.

TORONTO.

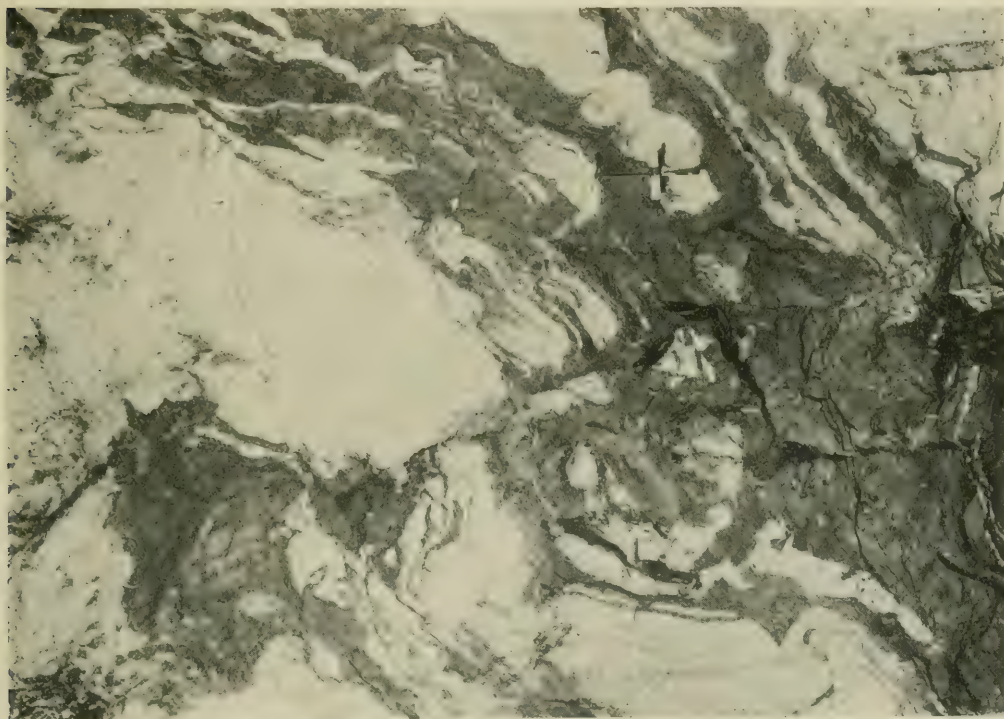
Porcupine.—The strike of miners, which began in the middle of November last, is ended. Though not officially declared off, the union men have been permitted to return to work, and those of the strikers who still remain in the camp have generally resumed labour. About two-thirds of the thousand or so who struck, including many of the most skilful miners, have sought employment elsewhere. The effect of the strike has been to retard the development of the district, by diverting investments to other undertakings and entailing the expenditure of large sums by the companies which continued in operation for recruiting their forces and protecting the men who remained at work. Many of the companies that closed down rather than go to the expense of fighting the strikers, have resumed work or are making preparations to do so. The Dome, which had secured the assent of its shareholders to an increase of the capitalization from \$3,500,000 to \$5,000,000, in order to increase the capacity of the mill from 40 to 100 stamps, has decided not to make any new issue of stock, but to finance the extension out of the profits of production. The Hollinger's latest report, covering the four weeks ended May 20, shows a marked decrease in production, partly due to the breakdown in the power-supply. The mill ran only 49% of the possible running time, treating 6550 tons at an average yield of \$17'53 per ton, as against 11,357 tons for \$23'44 per ton in the previous 4 weeks. The shareholders of the Crown Reserve, at a meeting held in Montreal, on June 11, confirmed the action of the directors in setting apart the McEnaney mine as a separate property. It has been transferred to a new company known as the Porcupine Crown Mines, capitalized at \$2,000,000. Crown Reserve shareholders are offered 440,000 shares at 80% in the ratio of one new share for every four held in the parent company. The employees are given the opportunity to take 26,664 shares at the same price. The Porcupine Crown will have the same board of

directors as the Crown Reserve. At the annual meeting of the McIntyre company, Harley B. Curtis, of New York, was elected president, in place of Albert Freeman. C. B. Flynn presented an estimate stating that the ore above the 400-ft. level, allowing for non-continuity, amounted to \$500,728 tons, of a total assay-value of \$4,879,272. The assay sheet showed gold contents of the orebodies ranging from \$7 to \$18'50 per ton, and taking the average at \$11, this should leave a net profit, after paying expenses, of \$7 to the ton. The mill at present has a capacity of 150 tons daily. Foundations for a second unit are complete, and the additional machinery is on the way. The Three Nations has 4000 tons of ore on the dump, and the machinery for a 10-stamp mill is being erected. The shaft is down 225 ft., and driving and cross-cutting have been done on two levels. Some good ore has been found on the 100-ft. level. At the Hughes-Porcupine a 10-ft. vein has been cut on the 200-ft. level. A small 2-stamp mill is running, and if the showing of the vein continues good with further development, a larger plant will be erected. The shaft is down 260 ft. The Swastika has been for some time in financial difficulties, and an increase of capitalization has been required in order to obtain further funds. Having secured the sanction of the shareholders to an increase from \$2,000,000 to \$3,000,000, the directors have put out an issue of 500,000 shares, which are being offered to the shareholders at 6 c. per share, the par value being \$1. The latest market quotation is 5½ c. This looks a good deal like 'frenzied finance.' In case the shareholders do not accept the offer, the directors are authorized to sell at any price they can get. The first clean-up at the Lucky Cross mill in the Swastika district yielded about \$6000 after a month's run. Five stamps are to be added to the mill, making a 10-stamp battery in all. The annual report of the Jupiter for the year ending March 31 shows an expenditure of \$175,482 on development work, and cash in hand to the amount of \$40,841. A rise from the 300-ft. to the 200-ft. level has been completed, disclosing some good ore.

Cobalt.—For some time fears have been entertained of a general strike of the miners affiliated with the Western Federation. All danger of this kind has been averted for the present by the decision of the union announced at the beginning of the month. The question was submitted to ballot, and, though a majority favoured the proposal for an immediate strike, it lacked the requisite two-thirds' vote. The

result excited a general feeling of satisfaction. The statement of La Rose for May showed profits of \$84,407, as compared with \$75,044 for April, the surplus, including the value of outstanding shipments, being \$1,752,150. The production for the month was 209,758 oz. silver, worth \$215,855. The Nipissing during May mined ore of an estimated net value of \$284,625. The high-grade mill treated 129 tons, and shipped 460,353 fine oz. bullion having a net value of \$276,748. Of this amount 162,381 oz. came from low-grade mill precipi-

a production of 2,235,853 oz. silver, and an increase in the reserve from 1,500,000 to 1,719,900 oz. The net income was \$891,192, and the surplus on hand \$623,028. The Seneca Superior, which struck ore in October last, has paid a third dividend of 10%, bringing up the total amount returned to shareholders to about \$150,000. A winze is being put down on the main vein from the 200-ft. level, and if the ore holds out, a new level will be run at 300 ft. At the Cobalt Lake a continuous shoot of high-grade ore has been developed on No.



Photograph]

THE HOLLINGER LODGE.

[by A. A. Cole.

tates. The low-grade mill treated 6544 tons. Hydraulic operations during the month resulted in the discovery of two veins. The McKinley - Darragh output for May was 206,781 oz., of which 42,662 oz. came from the Savage mine, which has been connected with the main mill by an aerial tramway over which 75 tons are being carried daily. The company has several thousand tons of low-grade ore on the Savage dumps. The capacity of the mill has been increased by the addition of 20 stamps and one tube-mill, and it is now treating 250 tons daily. The annual report of the Buffalo for the year ending April 30 shows

1 vein. The 40-stamp mill is in steady operation, treating about 150 tons daily. The Silver Cliff mine is showing up well under development, and has 3000 tons of milling ore in the stopes. A high-grade vein was recently found in cross-cutting. The mill, however, is making a poor recovery, and a new Chilean mill and six slime tables will be added. At the Keeley, in the South Lorrain district, now being operated by the English firm of L. Ehrlich & Co., a 3-in. vein of high-grade has been cut, and opened up for some distance. This property was acquired on the advice of Dr. J. Mackintosh Bell.

NEW YORK.

Chuquicamata.—The big news of the month was the announcement of the plans of the Chile Copper Co. for the development of its immense deposit at Chuquicamata. So far as it has been explored this deposit is known to have a length of 12,000 ft. in the shape of a narrow oval, which reaches a maximum width of 700 ft. and has been found to extend to a depth of 1000 ft. in places. Approximately 100,000,000 tons of ore containing 2·4% copper has already been developed, with probable additional ore of nearly equal amount. The deposit is in an arid region and is peculiar in that copper exists chiefly in the form of brochantite, $\text{CuSO}_4 \cdot 3 \text{Cu}(\text{OH})_2$, an uncommon copper mineral. The deposit has been worked in the past in a small way by a number of native and European companies, the method employed being the screening out of the fine from the surface material, called *llampera*. The copper mineral being most friable, the fine is comparatively rich in copper and was subjected to direct smelting. It has generally been supposed that the copper occurred chiefly in the form of atacamite, $\text{Cu}(\text{OH})\text{Cl}$, $\text{Cu}(\text{OH})_2$, but careful recent study has disclosed the fact that that mineral is actually present in only small amounts, the brochantite, which is also dark to emerald green in colour, having been mistaken for it; the presence of a small amount of chalcantite, the natural 'blue vitriol,' which would give a strong test for (SO_4) , aiding to produce confusion. In depth the brochantite changes to chalcocite, bornite, and chalcopyrite, about one quarter of the ore so far developed consisting of sulphides. The deposit is easily accessible, as a branch of the main line from Antofagasta to Bolivia now comes within a mile. The ore outcrops on the crest of a low ridge skirting the main range, so it is well adapted to steam-shovel mining, as there is almost no overburden to be removed. The ore will be mined by steam-shovels and loaded into cars in the usual way, and in the preliminary crushing-plant will be reduced by gyratories, crushers, and rolls to between $\frac{1}{2}$ and $\frac{3}{4}$ -in. size. It will then be distributed by a series of belt-conveyors into concrete vats, lined with acid-proof material and holding 9000 tons each. It is estimated that one day will suffice for filling a vat, 2 to 3 days for acid treatment and washing, and one day for discharging. An 8 or 9% solution of sulphuric acid will be used for the soaking, as the operation may be most accurately termed, for the brochantite is easily soluble in acid, requiring only the coarse crushing specified.

Whether on account of this, the strength of the acid, or the character of the iron minerals present, no trouble is experienced from the formation of ferrous sulphate, a common source of difficulty in leaching, as the solution does not seem to increase, with constant use, beyond an iron content of 2 to 3 grains per litre. No arsenic, antimony, or bismuth is present, so that the solution can be used almost indefinitely without fouling, and since the copper is originally present in the form of sulphate there will be no consumption of sulphuric acid, and it may, indeed, be necessary to dispose of small quantities. In order to procure the acid necessary for starting the plant, a small lead chamber acid-plant will be constructed, an ample supply of sulphur being available in the open market. The pregnant solution will be drawn off into vats preparatory to electrical precipitation and the ore washed with weak and barren solution. The vats will then be discharged by the use of clam-shell buckets, much after the system employed in reclaiming coal from stock piles, the leached residue being transported to the dump by a series of belt-conveyors. As the mill will be built upon a hillside having a 6° slope, and of great extent, ample storage will be available for the tailing. The copper-bearing solution will be subjected to electrolysis, this being the most difficult part of the metallurgical work, since electrolysis with an insoluble lead anode causes high consumption of electric energy. The chlorine present in the solution is a source of trouble, as it is liberated by the electric current and attacks the copper being deposited on the cathode, causing loss of efficiency. The nitric acid, which is also present to a slight degree, is a minor source of difficulty. Means of overcoming these obstacles have been devised, as the determination to build the first unit of the plant of 9000 tons per day capacity would indicate. The electric power required will be rather expensive, costing \$60 per horsepower per annum, as it must be generated at an oil-fired plant on the sea-coast, and the power transmitted approximately 100 miles to the mill. The contract for this electrical equipment, amounting to \$3,000,000, has already been awarded to a German firm, and it is hoped to have the whole plant in operation within three years.

New process. Much attention is being attracted by the Hall sulphur process, which has been devised to take care of the sulphur in smelting copper ores, and on which the First National Copper Co. (Balaklala) is about to spend considerable sums in large-scale experi-

mental work in its plant at Coram, Shasta county, California. The process, which has been devised by W. A. Hall, who is a cousin of the man of the same name who devised the aluminium process, consists of roasting the sulphide ore in such a way that while the metallic bases are oxidized the sulphur is not, escaping with the fume as flowers of sulphur. For this purpose an atmosphere of reducing gases and steam is employed, at a temperature between 600° and 900° C. The escaping sulphur can be collected by washing or by the use of the Cottrell system of electric precipitation, the latter apparently being more advantageous as the sulphur is obtained in dry form and the cost of the necessary equipment is much less. It is planned to apply the method in a modified McDougall roaster, but its possible application to blast-furnace work will also be tried. A. L. Walker, professor in Columbia University, has studied the process and reports that the preliminary experiments indicate that roasting can be carried on at a satisfactory rate, and the maximum cost of the sulphur produced should not exceed \$5 per ton. At this rate it should be able to dominate the sulphur market in the vicinity of San Francisco and would probably find a ready market, if not produced in too large amounts. However, if two plants were to use the process the bottom would promptly drop out of the sulphur market and the cost of sulphur production would become simply a charge on operating costs. The technical success of the process is therefore not so vital as the question of costs and the securing of a market for the sulphur produced. Tests on a working scale, which are to be made under the direction of H. F. Wierum, who has had extensive experience with smelter-fume in Tennessee, will furnish the answers to this question, and the outcome will be anxiously awaited by smelter men throughout the whole United States. The commission appointed by the Federal government to consider the problem of damage to national forests by smelter-fume has the process under close observation, as it is the most promising of all that have recently been devised.

Braden.—Pope Yeatman recently returned from an inspection of the Braden mine, in Chile, and in a report dated June 23 has made a new estimate of the ore reserves, which greatly increases the probable life of the mine. In the new estimate are included 16,660,750 tons of 2'65% ore developed, probable ore amounting to 8,749,444 tons of 2'63%,

and 18,742,745 tons of possible ore averaging 2'61% copper. The superintendent, Robert Marsh, Jr., ventures the prediction that 60,000,000 tons, averaging 2'50% copper, will eventually be developed. Work with the Minerals Separation process is still in a transition stage, as the 20 Hardinge mills have not yet all been installed, and the flotation plant is now obliged to treat material not of the proper size to secure the best results. These indicate, however, that the flotation process will maintain a recovery of between 70 and 75% on the mixture of oxidized and sulphide ores, and it must be remembered that much of this is material which does not give good results by any concentration method. During the past year a second blast-furnace, 46 by 180 in., has been erected, and a second Peirce-Smith converter installed. Three units of the power plant on the Cachapal river have been completed, and a dam has been built to divert the mill-tailing from flowing into the Coya and Cachapal rivers. The leaching plant has at last been started for a test run, and it has been found that the capacity of the H_2SO_4 plant is too small. Mr. Yeatman states that the cost of producing copper will be below the former estimate of 7'5 c. per pound, and calls attention to the desirability of extending the scale of operations.

Mexico.—During the month an international group of bankers placed a \$27,500,000 loan to meet the obligations of the National Railways of Mexico, which were pressing. Meanwhile E. N. Brown resigned the presidency, and the irregular operating conditions due to the growing revolutionary activity in the northern states makes the future of the enterprise look rather dark. It would not be surprising if before long Mexico had the obligations and the bankers the railroad. It is reported that Jose Y. Limantour has organized a foreign syndicate, of which Lord Cowdray is one of the chief spirits, to take over the National Tehuantepec railway. The road is 186 miles long, spanning the isthmus of Tehuantepec, and is now being operated by S. Pearson & Son, Ltd., under a 51-year lease. As a whole, the outlook for peace is decidedly discouraging. General Blanquet has replaced General Mondragon as Minister of War, but the telegraph continues to report the successes of the rebels in the north. The Huerta government is reported to be short of funds, the \$25,000,000 which has been advanced on the \$75,000,000 national loan having been eaten up by pressing obligations, with little prospect of an immediate further advance.

PERSONAL

AUDLEY H. ACKERMANN is home from Rhodesia and will spend part of his holiday in France.

WILLIAM BACH has returned from Siberia.

J. MACKINTOSH BELL was recently in Montana and is now in Arizona.

THOMAS BREAKELL returned from Russia on June 18, and expects to leave shortly for Asia Minor.

FRANCIS P. BRAY was at Broken Hill recently.

WALTER BROADBRIDGE has gone to the United States.

ALBERT BURCH is now manager for the Goldfield Consolidated, in Nevada.

CHARLES BUTTERS is here, on his way to Carlsbad.

G. B. BUTTERWORTH has returned from Colombia.

DONALD F. CAMPBELL was in southeastern France during June.

J. MORROW CAMPBELL is again in Northern Nigeria.

H. O. CRIGHTON is manager for the Nigerian Tin Corporation.

D. MICHAUX, representing the Champion (Nigeria) Tinfields, was recently at Arufu, Nigeria.

A. G. CHARLETON is attending the Geological Congress at Toronto.

A. P. CHITTENDEN was in London on his way to Paris.

E. H. CUNNINGHAM CRAIG is examining oil properties for the government of South Africa.

GORDON DICKSON, recently in Rhodesia, is now resident in London.

F. C. FREY is now stationed at Redjang Lebong, in Sumatra.

A. M. FINLAYSON, on his return from Burma, visited the Californian oilfields.

DONALD F. FOSTER has gone to the Broomassie mine, West Africa, as metallurgist.

W. H. GOODCHILD sailed on June 7 for South Africa.

ANDRE P. GRIFFITHS has returned from Mexico.

HARRY D. GRIFFITHS has been elected president of the Chamber of Mines in the Malay States.

L. S. GRISWOLD, of Boston, is in New Mexico.

H. W. HARDINGE is in Italy.

A. L. HAY, lately manager of the Hainault mine, Kalgoorlie, is on his way home.

H. C. HOOVER has returned from California.

T. J. HOOVER has become consulting engineer to the Murex Magnetic Company.

REGINALD E. HORE has succeeded J. C. MURRAY as editor of the *Canadian Mining Journal*.

J. J. HUNTER has been appointed consulting engineer to the Naraguta Extended.

D. C. JACKLING is now residing at San Francisco.

R. N. KOTZE, mining engineer to the South African Government, is in England on a holiday.

C. W. LEE is manager for the Redhill Development Syndicate at Selukwe, Rhodesia.

R. K. MACARTNEY is now manager to the Carnon Valley.

BEDFORD MCNEILL is attending the Geological Congress at Toronto.

F. H. MINARD passed through London on his way to Spitzbergen.

C. H. MUNRO has returned from South America and is now at San Francisco.

FRANK NICHOLSON, recently in Holland, is staying at Reigate, Surrey.

FRANK J. PENN-SMITH has completed a prospecting expedition in Northern Nigeria.

F. STEELE PILCHER has accepted a position with the Penoles company at Mapimi, Mexico.

FORBES RICKARD was at Philadelphia early in June.

PERCY SHERWELL is acting as manager of the City Deep during the absence of M. O. Tillard.

C. P. SMITH, for over 23 years manager to Fraser & Chalmers, has retired. He is succeeded by C. E. ROGERS, lately manager in Johannesburg for the same company.

WALTER J. STANFORD is at the Julia copper mine in Yenesei, Siberia.

A. ERNEST THOMAS is in Portugal.

E. J. VALLENTINE is on his way home from the Malay States, on a six months' vacation.

R. C. WARRINER, manager of the Crown Mines, is in America. He will return to Johannesburg in October.

H. H. WEBB has returned from the Rand.

R. W. WEEKES has formed a partnership with A. O. Kolkhurst.

H. V. WINCHELL is returning from the Argentine.

CHARLES W. WRIGHT is taking his usual summer leave of absence from Sardinia and will attend the Geological Congress in Canada.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Results from Sampling.

The Editor :

Sir — Honest criticism is one of the signposts pointing the way to progress and in that spirit I accept the comments of Mr. A. G. Charleton on my article, which appeared in the May number of your Magazine. By the same token I offer this as the reason for commenting on the results which form the subject-matter of the article.

I am only too alive to the fact that every mining engineer, who has the courage of his convictions, lives in a glass house, made of a particularly brittle kind of glass, and I would be extremely loth to hurl even the smallest pebble. My paper was not intended as a criticism of men, but of methods. I should feel very sorry to think that the quotation of these extremely interesting results would bring upon me the charge of damaging other men's reputations, nor did I do it, as suggested by Mr. Charleton, with an idea of glorifying my own work to the detriment of other men's. It is quite natural for me to assume that the basis of my calculations is the correct one, and I feel that assuming that fact as a hypothesis does not necessarily lay me open to the charge of egotism. It was not, however, with an idea of showing the correctness of my own results that I wrote the article, but rather with a view, as stated in the article, of drawing attention to the peculiar agreement in the average assay-value, despite the great variation in the methods employed in sampling a deposit, which was particularly difficult to sample.

I think Mr. Charleton misinterprets the position by stating : " It must be put to the credit of all the engineers that there is a maximum difference of only about 10% in the average assay-value obtained by their sampling of the mine, although the method of arriving at their results differed considerably." Were it not for the similarity of these results, the article never would have been written.

I do not feel that I am slinging mud when I frankly criticize some of the earlier samplings in the manner I do. It was unnecessary to burden the paper with details, but a perusal of the reports from which these statements were taken is sufficient justification of

my view. There are certain accepted methods of mine sampling and valuing, and when one finds an engineer taking samples at 2-foot intervals and combining a number of them to make one sample, it is no injustice to say that it is bad practice.

In drawing attention to the difference in the estimates of ore reserves, Mr. Charleton opens a subject about which there is insufficient data in the paper to enable one to form any judgment. I am afraid that it will be necessary for me to state that Mr. Charleton must be satisfied with my mere statement that there is no justification for the inclusion of any tonnage of ore between the two mines, otherwise I will have to encroach too much on your space in order to explain it. I think Mr. Charleton will agree with me that one has no right to assume any tonnage of ore where no values are known to exist.

The mistakes in the figures pointed out in page 365 were due to the fact that the \$498,865 refers to the recoverable value, as the gross value, 63,008 tons at \$9½, amounts to \$598,576. I would also like to call attention to an error in the second line from the bottom; the word "inclusion" should read "exclusion," in other words the erratic high assays should have been eliminated. Another typographical error is in the foot-notes to the table, as (8) (9) should read "The ore in the dump came from the lower level, *where* assay-values are higher."

C. S. HERZIG.

London, June 21.

[Mr. Charleton's letter was just the corrective required for Mr. Herzig's interesting contribution.—EDITOR].

Scientific Prospecting.

The Editor :

Sir—The art of discovering new metaliferous deposits is, as Mr. Stephen Lett indicates, a branch of economic activity that is rapidly approaching an acute stage. The older mines are becoming exhausted and new ones are not forthcoming in sufficient number to replace them. Collaterally with this state of affairs on the producing side, there is an ever increasing annual demand for the mineral products. The whole subject of prospecting,

therefore, or the art of discovering ore deposits, is one to which professional men might, with no small justification, give a little more scientific consideration.

Mr. Lett characterizes the present age as an age of science. It might in this connection with equal aptitude, I think, be described as an age of ignorance. Newton, toward the end of a life of careful study and research, and in a flash of intuitive genius, likened his store of knowledge to a few pebbles gathered from the sea-shore. While the sum total of human knowledge might, perhaps, with equal force be likened to as much as a few cartloads of pebbles, there yet remains the shore with its vast unknown possibilities. The particular possibilities to which I wish to draw attention in this letter are connected with the finding of ore deposits such as give little or no surface indications of their existence by the more commonplace methods of observation.

Broadly speaking, the bulk of the world's industrial supply of metals has been derived hitherto from ore deposits that either have shown their 'best end up' or have given more or less striking evidence of their presence by various outcrop chemical phenomena. Mining operations at depth, however, have on many occasions resulted in the discovery of orebodies that do not reach the surface and whose existence could not have been surmised with any degree of definiteness from ordinary geological observations at surface. A necessary condition for the discovery of such deposits has been proximity to a neighbouring mass in course of exploitation. It is not merely conceivable but probable that numbers of metalliferous deposits exist whose proximity cannot be inferred from observations of any chemical or geological phenomena apparent at surface. One of the problems to be faced in prospecting therefore is to find an economical method or methods whereby the existence and position of these concealed deposits may be approximately demonstrated.

Scientific prospecting, as outlined by Mr. Lett, consists mainly in a closer and more scientific observation of the ordinary visible chemical geological phenomena and in deductive reasoning therefrom; the old time-honoured methods of prospecting, in fact, dressed in a modernized and somewhat more attractive looking suit of clothes.

The limitations of these methods are too obvious to call for further comment; moreover, in prospecting by them no particular attention is paid to the energy aspects of ore occurrence. Modern chemical science is so intimately

bound up with considerations of the various manifestations of energy associated with chemical phenomena, that it does not seem too much to anticipate that, in the future, considerable assistance in the art of discovering ore deposits may be derived from the re-distributions of energy that must be continually going on within and in proximity to ore deposits. In the case of strongly magnetic minerals use has already been made of electro-magnetic phenomena in prospecting operations, such as the magnetic survey by the Swedish method of the Sudbury nickel district. Water 'divining' may now be said to have been placed on a scientific basis. The results obtained, particularly in India, by the Mansfield water-finder, prove beyond question that the position of masses of subterranean water can be defined with a high degree of precision under circumstances where its presence could not be predicted by the ordinary methods of geological deduction from any other kind of surface observations. The frequent association of moving water with ore deposits makes these results of particular interest to mining engineers. The action of the instrument depends upon the quantitative differential registration of electro-magnetic disturbances under special favourable conditions, the disturbance arising primarily from the fact that the waters are not in a state of complete equilibrium. The instrument is said to be capable of detecting the presence of metalliferous ores by similar means. Water 'divining' by means of the 'dowsing rod' thus becomes susceptible of a reasonable explanation. Many of the Cornish lodes are said to have been discovered by the aid of the dowsing rod. It appears to be the custom of professional men to regard 'dowsing' as something of the nature of the old wives' superstition and necessarily devoid of any sound physical basis.

In the light of modern physico-chemical research, particularly as regards developments of the theory of equilibrium, it seems highly probable that masses of metallic sulphides and other metalliferous ores buried in the earth's crust at moderate depths, may, under certain conditions, give rise to electro-magnetic disturbances that could be detected at the surface by suitable means, even in the case of ores that it is customary to regard as non-magnetic. In this connection the peculiar behaviour, in nature, of the metallic sulphides toward oil, and certain other fluids, upon which the flotation processes are based, is not without significance. It is evident that the free

surface of an untarnished sulphide is a seat of peculiar energy, and differs, at least in degree, in a pronounced manner from a crystalline quartz or silicate surface. There is likewise a large amount of evidence in favour of the view that the interfaces of sulphide-quartz, or more broadly, sulphide-gangue, such as are extensively developed in most ore deposits, are the special seats of quantities of electromagnetic energy that would, under the slight but practically continuous variations in the statical conditions of ore deposits, give rise to re-distributions of energy that would in turn originate phenomena that could be detected at or near the earth-air surface, and which might be put to practical account in the discovery of concealed orebodies. The special and rather peculiar physico-chemical properties of silica and silicates as compared with those of the naturally occurring sulphides of the heavy metals must not be overlooked. With these facts before us, it is surely time that the possibilities of what I may call "energy methods" of prospecting should receive adequate attention from scientific men.

The hitherto inexplicable behaviour of the 'dowsing' rod may, on thorough investigation, prove to be the crude and unreliable forerunner of more or less precise methods of detecting the presence of orebodies that give no other marked surface indications of their presence.

W. H. GOODCHILD.

S.S. Walmer Castle, Madeira, June 10.

Exit Jemaa.

The Editor:

Sir—Mr. Herzig's letter, appearing in your April number, under the title of 'Exit Jemaa,' in which he commends a two-hour examination of some 70 square miles, reminds me of a paragraph in a popular penny paper, which came to my notice some years ago, to the effect that "Mr. X, the eminent mining engineer, draws a salary of £80,000 a year, and is such an able and clever expert that he does not require to visit a property in order to determine its value, but can do so from his office." The engineer, who in two hours was able to arrive at a definite conclusion as to the ultimate value of the Jemaa property, may certainly hope, with a little more experience, to rival and perhaps surpass the "cleverness" attributed to Mr. X, for if he can form an opinion on a property he has never seen, he may presently be able to do the same for a property of which he has never heard.

I fail to see that reports made for Stock Exchange reasons are necessarily dishonest; I should call them merely unauthorized guesses, made for clients or friends who want to buy or sell shares.

WILLIAM R. RUMBOLD.

Nigeria, June 6.

[In regard to our comment on the Anglo-Continental fiasco, we have received a letter from Mr. A. Basil Reece objecting to our reference to Mr. Rumbold as that company's "one trustworthy technical adviser," because he (Mr. Reece) was in the employ of that company at the time mentioned. Mr. Reece was specially engaged for work at Jemaa, and it was principally on the data collected by him that Mr. Rumbold condemned the so-called lode. It was on Mr. Reece's report also, we are now informed, that the directors of the Anglo-Continental ceased operations on the Gurum Extended. We, of course, know Mr. Reece by repute; we know that he was formerly a partner with Mr. Rumbold in Bolivia; we published an excellent article by him on 'Tin-dressing in Bolivia' in our issue of March 1911. We are glad, therefore, to remove any misapprehension that may have been occasioned by our reference to a solitary adviser. If the Anglo-Continental people had asked and obtained the advice of either Mr. Rumbold or Mr. Reece at an early stage in their blunders, they might have saved a lot of money, for other people.—EDITOR].

Bushvelt Tin Deposits.

The Editor:

Sir—As one who has seen something of tin deposits in Australia and in South Africa, I must confess myself appalled at your editorially approving of the theory put forward by Mr. G. H. Blenkinsop regarding the above ore deposits. You say Mr. Blenkinsop "punctuates a fallacy," and has shown that the study of local rock-structure is of more importance than theories of origin. I, and I think a few others, would say that you have countenanced the perpetration of a monstrosity in the way of theories. You have lent your approval to the most revolutionary of geological hypotheses, when it has been put forward without one particle of evidence to support it, and has been flung in the face of all the scientific evidence produced by the members of the Geological Society and Survey without even an apology or a note of hesitation. Surely, Mr. Editor, you were caught napping? Let us read it again. "There is, however, evidence that the so-called pipes and

fissures are fractures caused by mechanical stress or strain [I always believed stresses caused strains] and that the cassiterite contents are derived from the erosion or denudation of formerly overlying rocks containing cassiterite." "Cassiterite is here a secondary mineral derived from the erosion of rocks that formerly overlaid the present surface." By the shades of the Neptunists, Mr. Blenkinsop is too modest. Does he not see that on this theory we can now account for all tin deposits everywhere? As the accessory minerals found in the pipes and fissures are amongst others tourmaline, copper pyrite, mica, secondary quartz, feldspar, sericite, calcite, chlorite, fluorite, galena, zinc-blende, arsenopyrite, molybdenum, iron pyrite, and antimonite, he can thus account for most ore deposits anywhere. All were ores derived from pre-existing rocks. The denuded rocks derived their ores from pre-existing rocks likewise denuded, and so on *ad infinitum*! Is it time to stop? Or, might we ask what were the vadosic solutions that performed this amazing work in dissolving and re-precipitating SnO_2 with the sulphides and fluorides? How, why, and when they worked, and how these deposits differ from those of Cornwall or Australia? Meanwhile, we will endeavour with difficulty to maintain that attitude of the open mind so essential to the true scientific man, until we have the evidence asked for.

E. M. WESTON.

Brakpan, June 15.

[On the receipt of Mr. Weston's vigorous protest we have read again the letter from Mr. Blenkinsop and the editorial paragraph commenting upon it. We did not endorse Mr. Blenkinsop's theory of secondary deposition from the erosion of the upper portions of the tin veins. If we appear to have done so, we apologize to Mr. Weston. Nor did we endorse the theory of primary deposition by vapours emanating from great depth. That has yet to be proved. The members of the Geological Society and Survey are not convincing on problems of ore deposition; their *forte* is stratigraphy and paleontology. We did, however, endorse Mr. Blenkinsop in his main attack, which was directed against a purely local supposition that the tin deposits must necessarily favour the upper granite horizon because they emanate from tin-bearing vapours rising from a body of magma. We discredited this hypothesis in order to lay stress on the necessity for a careful study of the rock-structure, which, it seemed to us then, and it seems to us now, is more immedi-

ately conducive to the finding of ore than vapourizing concerning the genesis of the deposits. Mr. Weston makes fun of Mr. Blenkinsop's suggestion. The idea of ore being derived from pre-existing deposits *ad infinitum* may be humorous, but many a true word is said in jest. Ore deposits essentially are re-concentrations; they represent the last phase of a long migration, due to chemical causes and modified by physical conditions. Certainly, they were derived from pre-existing rocks. If not, where from?—EDITOR.]

Esperanza.

The Editor:

Sir—Our attention has been called to a paragraph on page 465 of your June issue, in which it is stated that "the English company received £34,300 as dividend for 1912 from the American company, and £30,614 was distributed as dividend among English shareholders, being at the rate of $7\frac{1}{2}\%$."

We should like to point out that the Profit and Loss account shows that a further sum of £34,600 was declared as dividend by the American company on December 15, 1912. This was for the six months ended December 31, 1912. Similarly the Balance-Sheet Appropriation account mentions a dividend of £30,794 as having been paid on January 16, 1913. This was also for the six months ended December 31, 1912. You will see, therefore, that the total distribution in respect of the year ended December 31, 1912, was (1) by the American company, £69,200, and (2) by the English company £61,400, being at the rate of 15% per annum.

ESPERANZA, LIMITED.

A. Southern, Secretary.

London, July 3.

Pig iron made by the Tata Iron & Steel Company has recently been shipped from India to the west coast of the United States. Hitherto the exports of this firm have been confined to Japan, China, and Australia. During two years as much as 75,000 tons of pig iron has been sold to consumers in Japan, and China and Australia between them are taking about 2000 tons per month. An official statement gives the cost of making the pig iron and delivering it to Calcutta at 29 to 33 shillings per ton. The cost delivered to San Francisco is estimated at 47s. 6d. per ton, and in addition 10s. 6d. has to be paid at present as import duty, bringing the total cost to 58 shillings. The price of American pig iron in San Francisco is from 89 to 95 shillings.

DRILLING ALLUVIUM IN SIBERIA.

By R. E. SMITH and H. G. HANN.

DURING the past winter we had occasion to drill a gold-bearing area in North-eastern Siberia, and believing the readers of *The Mining Magazine* will be interested to know the results obtained and the methods employed when using hand-drills under the conditions ruling during a Siberian winter, the following is submitted.

The area tested contained gravel of medium firmness, and from fine to medium size. The drill-holes averaged 18'8 feet in depth, although several were over 30 ft. deep. The snow was 2 to 4 ft. deep, depending on whether it lay in exposed or sheltered places. Surface frost ranged from a few inches to 5 ft. in depth, and the ice on the surface of the ground was often 4 ft. thick. Most of this ice was formed, and was being continually increased, by the alternate overflowing and freezing of surface-water passing over what in summer is quite wet swampy ground.

Drilling commenced on November 25, 1912, and ceased on March 12, 1913. Below are given the temperatures in degrees Fahrenheit for this period as taken daily at 8 a.m. with a tested mercurial thermometer.

Date of November Month	December	January	February	March
	In Degrees Fahrenheit.			
1	-29	-4	-22	-25
2	-27	0	-14	-28
3	-25	-27	-10	-29
4	-27	-2	-20	-26
5	-27	-12	-27	-10
6	-25	-2	-6	0
7	-29	0	-1	-10
8	-29	0	-3	0
9	-27	-17	25	5
10	-29	-27	19	8
11	-27	-24	-5	8
12	-27	-24	3	10
13	-37	-38	-5	
14	-36	-15	-35	
15	-37	-39	-32	
16	-38	-33	-32	
17	-39	-33	-18	
18	-25	-32	-31	
19	-18	-30	-36	
20	-17	-20	-35	
21	-25	-30	-28	
22	-42	-28	-10	
23	-42	-28	-3	
24	-15	-30	-10	
25	-7	-10	-35	-27
26	-22	-13	-20	-28
27	-11	-32	-27	-34
28	-27	-36	-28	-10
29	-30	-37	-19	
30	-32	-22	-26	
31		-28	-29	
Averages	-21'5	-28	-22	-9

On December 22 and 23 the mercury in the thermometer froze, but a spirit thermometer three versts distant from our camp registered 45° below zero. At no time during the first two and a half months was the mercury observed to be above zero, although on a few stormy days it rested at that point. During this period of the shortest days the temperature rose by noon slightly above the morning reading, frequently not more than 10 degrees.

The first drill began work on November 25 and the second on December 16, and both continued until March 12. Collectively the two machines were in commission 193'5 days and drilled 3347 ft. (178 holes) at a cost of 14'4 d. per foot for actual hire of labour and horses.* The following table shows the distribution of time.

Operation	Calendar Days for both drills	%	Feet per day per drill	Feet per hour per drill
Drilling.....	123'5	63'7	27'2	3'3
Putting on pipe.....	5'6	2'9		
Pulling pipe.....	9'6	5'0		
Clearing away snow and brush around holes.....	3'5	1'8		
Moving from hole to hole.....	5'5	2'8		
Moving from line to line.....	6'0	3'1		
Lost time while drilling.....	3'6	1'8		
Total time in field.....	157'0	81'1	21'3	2'6
Moving camp (twice).....	3'5	1'8		
Lost time, account storms.....	17'0	8'8		
Lost time, account holidays.....	10'0	5'2		
Lost time, resting crews.....	6'0	3'1		
Totals.....	36'5	18'9		
Grand totals.....	193'5	100'0	17'3	2'1

Divide by 2 to get actual number of days for each drill.

Two 4-inch Empire drills with the ordinary tools, excepting horse-power attachment and pulling stand, were used. Dispensing with these two heavy parts lessened the total weight of the drill considerably. Thus much time was saved in moving (the pulling-stand is an unwieldy burden in the soft snow), with no hindrance in the drilling operations attaching to the absence of these two devices. A common wooden pole, 4 inches in diameter, supported by the pulling-chain looped from the outer edge of the platform, was substituted for the horse-power attachment. In pulling the pipe the wooden driving-ram was used as a fulcrum and replaced the iron pulling-stand,

*[This cost includes all expenses in the field except the salary and subsistence of the engineer in charge. No account is taken of the original outlay on the drill or the transport of the equipment. These vary in each case, but they are readily ascertainable.—EDITOR.]

and the lever was used either with the pulling-head or the pulling-chain as the height above ground of the pile-column demanded. Each drill had a sheet-iron bucket (of 24 in. diam. and 28 in. deep) in which to heat water for drilling and panning. Two galvanized tubs 28 in. diam. were used in sampling, one being

the fire. No difficulty was experienced in keeping the rods free of ice; in fact, the heat from the water in the casing and the proximity of rods to the fire when not in use resulted in ice forming on them infrequently. Some ice formed on the platform, but a few blows with a hammer on the platform when it was taken off, to add more pipe, kept the surface of it in such good shape that the men had no difficulty in maintaining their balance. The lengths of pipe were warmed at the fire and the threads lubricated with a mixture of graphite and oil before being used. Before beginning operations it was thought a large tent over the drill would be necessary as protection against the



Pulling Casing.

placed under the end of the wooden dump-box and the other for the panner, or man who did the panning of samples.

The drilling operations were the same as in summer with the following exceptions: hot water was used in drilling and to wash out the sand-pumps and to keep the sample-box free of ice. Live coals occasionally thrown under the sample-box tub kept it free of ice. The

panning-tub was placed close to the fire used in heating water, and the water in it was kept at a comfortable temperature by throwing out a bucketful of the too cold and adding hot water as required. Very hot water in the tub was avoided because the steam arising therefrom interfered with panning. The sand-pumps and drill-rods when not in use were placed near



Rotating with Horse.

severe cold, especially when accompanied by wind; but this was found unnecessary. It was proved that with slight winds no protection was necessary, and with fairly strong winds a small tarpaulin placed on two upright sticks broke the force of the wind to the panner. Strong winds were nearly always accompanied by snow, and only in such weather was work

found to be impossible. Intense cold did not stop operations. On several days during the first half of the morning the work was carried on successfully in temperatures around the freezing point of mercury.

Koreans manned one drill, and a mixed crew of Russians and Koreans the other. A horse was used on each drill for rotating. It was intended to have 7 men daily on each machine, but fatigue and sickness often brought the crews down to 6, and sometimes to 5, labourers on each drill.

The average time worked per day was 8 hours 20 minutes. During December and January the hours of daylight were less, and although the drills operated from 8 a.m. to

took place in good light. Where the distance to work exceeded $\frac{3}{4}$ of a mile (and this was more often the case than not) 'lunch' was taken in the field. Holidays caused a loss of only 5 days, an exceedingly small loss in a country notorious for the number of holidays on its calendar.

Given the testing in summer of this same area, which is then quite wet and swampy, un-



Panning.



Drilling at Low Temperature.

5 p.m., this was only possible with the aid of lanterns, both morning and evening. It was found impossible to pan by lantern light, and when lanterns were in use the samples (for each foot) were allowed to collect until they could be panned by daylight. No attempt was made to crowd the work, more attention being paid to obtaining a proper sample than to increase the daily footage. As far as possible the work was arranged so that the panning of the gold-bearing portion of the hole

doubtedly much more time than in winter would be required, and some difficulty would be experienced in moving the drills. The machines were shifted from place to place with little trouble. Ordinarily, in making long moves, each drill was carried on a one-horse sled and in one instance an entire drill was hauled on a dog-sleigh. The average distance the drills were moved between the lines of holes was 6083 ft., and the average time consumed per move per drill was 2 hours 5 minutes. In moving from hole to hole the drill was carried on the backs of the labourers and the average time per move per drill was less than 17 minutes. One man on each drill was occupied most of the time in breaking a path to the next hole, in clearing away snow and brush

around the hole, and in cutting wood and thawing snow for water.

Usually a hole was dug through the frost-bearing portion of the top material before the pipe was started, but where this frozen layer was thicker than two feet time was saved by drilling the remainder of the layer. By using plenty of hot water and employing the drill-bit below the end of the casing frequently, not much difficulty was experienced in getting through the frozen part. In several instances, where ice covered the ground, water flowed from the hole excavated through the ice and caused difficulty in wedging the pipe to a vertical position, and often it was found easier in such cases to have the men hold the platform and pipe upright until the pipe had been sunk to a sufficient depth to give it stability.

The cast-steel handles sent out with the drills caused considerable trouble and delay by crystallizing in the severe frost and snapping short. Wooden handles, made of white birch, were substituted; these worked satisfactorily and were not so cold to the men's hands.

In dressing, convenience was found as important as warmth. Long coats and too many garments made it impossible to move about easily and quickly. It was found that if the head and extremities were well protected, an extra pair of heavy trousers and a short fur-lined jacket over one's ordinary costume kept the body warm. Fur caps with flaps coming well down on the neck, and covering all but the eyes, nose, and mouth, were a necessity. A long woollen muffler proved better around the neck than a fur collar. Fur mittens were used while travelling, but leather ones were more convenient for handling tools. A little practice made it possible to keep all but the fingers dry in panning, and after each operation the hands were dried on a towel and warmed at the fire. By keeping the back to the wind, and the hands well down in the panning-tub (which is facilitated by keeping the water low in the tub), little trouble was experienced. However, the hands will crack unless treated every day or two with glymiel jelly compound, or some other preparation. Experience quickly teaches that it is well to avoid picking up anything metallic with bare hands. Although nothing serious may result from such a frost-bite, it is painful, especially if the frost is severe enough to take the skin. Native deer-skin boots with dog-skin socks are excellent for going through the light dry snow, but around the drill and fire the common Russian felt boots are warmer, keep

drier, and are not so easily injured by sharp sticks, stones, or the fire.

The Loetschberg Tunnel.

On June 28 the Loetschberg tunnel penetrating the Bernese Alps was opened for railway traffic. This is the fifth of the great railway tunnels driven through the Alps. The first was the Mont Cenis, between France and Italy, $7\frac{1}{2}$ miles long, commenced in 1857 and completed in 1871. Next came the St. Gothard, $9\frac{1}{2}$ miles long, commenced in 1872 and completed in 1881, connecting Lucerne with the Italian lakes. The Aarberg, connecting Lake Constance with the Tyrol, is $6\frac{1}{2}$ miles long, and took 3 years, from 1880 to 1883, to build. The longest of all is the Simplon, $12\frac{1}{2}$ miles long, between the head of the Rhone valley and the Italian lakes, commenced in 1893 and completed seven years ago. The Loetschberg tunnel forms part of the new railway between Thun and Brieg, the latter being at the mouth of the Simplon. This tunnel is 9 miles long. The north entrance is 3940 ft. above sea-level, and the south 4000 ft., while the summit of the tunnel is 4081 ft. above the sea. At first it was designed to accommodate only a single line of rails, but subsequently the plan was altered for double track. In cross-section, the tunnel is 20'7 ft. high, 25 ft. wide on the road-bed, and 28 ft. wide at the springing of the semi-circular arch. As regards the geology, the northern end is in calcareous Tertiary rocks, the southern in crystalline schists, and the central portion in granite. An unexpected accident occurred when the tunnel had been driven a little more than $1\frac{1}{2}$ miles from the northern entrance. A cleft full of water and detritus was here encountered, and the inrush was so sudden and severe that not only were 25 workmen overwhelmed but 6000 ft. of the tunnel was filled with debris. There was no alternative but to block the tunnel with a wall 33 ft. thick at a point 4675 ft. from the portal, and to make a deviation, thus adding half a mile to the total length. The driving of the tunnel was done from both ends. At the northern end, Meyer drills were used, and Ingersoll-Sergeant drills at the southern end. The power for operating the air-compressors was purchased from hydro-electric installations. The trains are to be hauled by electric locomotives. It was found that the electric haulage at the Simplon was highly advantageous in the improvement of ventilation, and that the conditions were much better than at the Gothard, where steam locomotives are still used.

HOMESTAKE AND WASP

Two low-grade gold mines. Remarkable achievements.

By JESSE SIMMONS.

HOMESTAKE.—With the ending of 1912 the Homestake Mining Company closed the 35th year of its existence, making it memorable by recording in that twelve-month the greatest yield of gold in its history. During the year \$6,600,953 was produced, making the total \$110,000,000. In 1912 the dividends amounted to \$1,310,400, swelling the grand total to \$28,000,000. Homestake shares have a par value of \$100 each, and for many years the dividend has been at the rate of \$6 per share per year. Commencing with January, 1913, the rate was raised to 65 cents per share per month or \$7'80 per annum. In addition to this, the shareholders were in March given a stock dividend of 15%. Maintaining the same dividend rate, the disbursements for 1913 will be \$1,916,460. Further, the company paid a bonus of 7% to its employees at the end of 1912, at a cost of about \$200,000. When it is considered that this accomplishment comes from working ore yielding less than 5 dw. gold per ton, the result is recognized as truly remarkable.

Amalgamation and cyanidation are used in the recovery of the precious metals, the combination of processes yielding 94% of the assay-value. The ore is raised in cars, holding one ton, which are trammed short distances, 100 or 200 feet, to the gyratory crushers. These machines, which are 16 in number, of the pattern known as Gates No. 6, are operated by individual motor-drives, a 35 hp. motor being belted direct to each crusher. From the bins into which the crushed ore drops it is conveyed to the stamp-mills either by trains operated by compressed-air locomotives, or, as at the De Smet, by belt-conveyor.

There are 6 stamp-mills, with a total of 1000 stamps, in which are reduced 4200 tons of ore daily, the crushed ore, which will pass a 2½-inch ring, being fed direct to the stamps. Dropping 90 times per minute from a height of 8 inches, these stamps, with an average weight of 850 lb., work in a narrow mortar, which is closed on three sides. The screen used is a diagonal slot, with an opening 0'022 by 0'5 inch. Extensive amalgamation plates are used, in the newest, the Amicus mill, there being a total of 621 sq. ft. of plate-area to

each 10 stamps. On these plates 72% of the gold in the ore is recovered. Back-g geared motors of 25 hp. are used to operate the stamps, one of these motors being belted direct to the bull wheel on the cam-shaft serving 10 stamps.

From the 3 mills at Lead, containing a total of 640 stamps, the pulp is piped to the re-grinding plant, where rough classification in cones removes 8% of the material, which is fed to 3 tube-mills (two are 5 by 18 ft. and one is 5 by 14 ft.) and amalgamated later. The principal duty of this plant is to grind the coarse material that has passed through broken battery-screens, etc. Uniting with the main flow of pulp, the whole is piped to an extensive system of Merrill classification cones, where the sand and slime are separated, each going to a treatment plant. Of the weight of ore crushed in the stamp-mills, 57% is treated in the sand-plants and 41% in the slime-plant, there being thus a deficiency of 2%, believed to be mechanical loss of slime.

Sand-treatment plants are two in number, one at Lead and one at Blacktail, each situated so that the product comes to it by gravity. The single slime-plant is at Deadwood, to which the pulp also comes entirely by gravity. In the sand-plants the process consists essentially of dewatering the pulp, aerating, leaching with solution of sodium cyanide and precipitation by the Merrill zinc-dust method. The ores, according to Messrs. Clark & Sharwood, contain ferrous compounds, and to overcome the deleterious effect on cyanide solutions, frequent and thorough aeration is required. The treatment of sand at these plants costs 30 cents per ton.

At the slime-plant are installed 28 Merrill presses, each of which makes a cake 4 by 6 feet by 4 inches, and as each press contains 92 frames, the content is calculated at 25 tons per charge. The cycle of operations beginning with the filling and ending with the sluicing of the residue consumes 7½ hours, and includes periods of aeration, contact with solution, and washing. Zinc-dust precipitation is used. The total cost averages 28 cents per ton of slime.

The aggregate mining, milling, and general expenses were \$2'958 per ton, and as the 1,528,923 tons milled yielded an average of

\$4'3174 per ton, there was an apparent profit of \$1'359 per ton. The proved ore reserve consists of 15,000,000 tons, and the probable ore is estimated at 40,000,000 tons in addition. The Homestake maintains its own machine-shop, foundry, lime-kiln, saw-mills, and at Spearfish a hydro-electric plant, from which power to operate all of the crushers, stamps, mine pumps, and surface plants, is obtained. At Hanna, the source of the water-supply, is a steam-driven pumping plant, which raises the water over a divide 382 ft. high. From the top of this divide the water flows in a steel pipe to Englewood, where 600 hp. is developed

of soil, shale, and loose sandstone. This overburden is shaken by blasts of black powder and trammed to the waste dump. On the north side of the open-cut, where the overburden is the heaviest, a steam shovel is in use for filling the cars, and a small electric winding engine draws them to the dump. When the top of the ore is cleaned, a hole is drilled almost vertically, by air-drills, at a point which gives the hole a burden of a cube, the faces of which are roughly 20 ft. The hole, after being chambered 3 or 4 times, is loaded with as many as 50 kegs, of 25lb. each, of black powder, the explosion of which breaks



THE HOMESTAKE MINE AND LEAD CITY.

for use in conjunction with the supply from the Spearfish plant.

Although 35 years old, this mine is, as Superintendent T. J. Grier recently remarked, just reaching its prime, and much greater accomplishments may confidently be anticipated for the next 35 years of its life.

WASP.—By the payment of dividends upon the treatment of ore yielding less than \$2 per ton, the Wasp No. 2 mine, near Deadwood, is rapidly becoming famous for making a profit on what would be considered waste at many properties. Probably nowhere else is the total cost of mining, milling, and general expense kept below \$1'25 per ton for regular operations spread over long periods.

At this property the ore deposit, a bed of Cambrian quartzite 19 to 20 feet thick, lying almost horizontal, is covered with a few feet

as much as 5000 tons of ore. Fully two-thirds of this broken ore is small enough to be shovelled or lifted by hand into the cars, or skips, and the rest is blasted with dynamite, small air hammer-drills being used for the drilling. The skips, holding 5 tons each, are drawn up an incline a distance of less than 2000 ft. to the top of the mill, where they dump automatically into bins above the crushers. The maximum grade of this incline is 1 in 10, and the average is 5 in 100. A 52 hp. electric winding engine is in use for drawing these skips to the mill. All of the mining work is in the open air, and is done during the day time. A portion of the ore is taken to the mill at night.

From the bins above the crushers the ore is drawn to two No. 6 Gates machines, elevated 38 ft., and passes through two No. 4

Gates crushers. It is thus reduced to pass a 1-in. ring, and drops to a bin of 500 tons capacity. From this bin shaking feeders deliver it to 2 sets of 14 by 36 in. McFarlane rolls, passing which it is elevated 40 ft., screened, the oversize returned to two similar size rolls, their product elevated and screened, the oversize returning to the same rolls. The screens are 2 by 7 ft. in area, and are constructed of No. 8 steel wire having a rectangular opening $\frac{1}{4}$ by $\frac{3}{4}$ inch. The portion passing the screens drops to a bin of 700 tons capacity, from which it is charged dry by a system of 18-inch troughing belt-conveyors to any one of 6 leaching vats. The porous nature of the ore, and the fact that the principal gold content has been found to lie along cleavage planes, makes fine crushing unnecessary in order to secure a commercially profitable extraction of the gold. The leaching vats are circular, 32 ft. diameter, and 12 ft. deep. During the filling of a vat, cyanide solution of a strength of 5 lb. KCN per ton is added, and as soon as the vat is full of both ore and solution, the valve in the bottom is opened and solution drawn off as fast as it is added at the top. At the end of 12 hours the supply is shut-off, and 6 hours later the charge is fairly dry. During this treatment 120 tons of solution has come in contact with the charge and 60% of the total recovery has been effected. The charge is given further treatment with 7 washes of weak solution ($2\frac{1}{2}$ lb. KCN per ton), each of which consists of 50 tons of solution. A wash with water concludes the treatment, and the vat is discharged by men shovelling it through the gates, 4 in number, in the bottom of the vat, under which are laid tracks for cars holding 2500 lb. of the residue. In 7 to 8 hours time 7 men will empty a vat at a labour cost of 5 cents per ton, the men being paid \$3 per day.

Zinc-shaving is used as a precipitant, and the precipitate is melted three times in each month. The entire plant is operated by electricity, the power being purchased at a cost approximating \$100 per hp. per year. Miners are paid \$3.50 and shovellers \$3 per day. Mill-men are paid a similar scale.

During 1911, 160,860 tons of ore were treated for a yield of \$286,160. Mining costs for that period were 53.48 cents, milling 66.82 c., and general 4.35 c. per ton, a total of \$1.2465. Dividends were \$60,000. In 1912 the yield was \$308,174 from 158,840 tons, an average of \$1.94 per ton. Operating profits in this year were \$115,000, of which \$85,000 was disbursed in dividends.

Petroleum in Papua.

The report on the occurrence of coal, petroleum, and copper in Papua, or British New Guinea, made by J. E. Carne, has been published by the Department of External Affairs of the Government of the Commonwealth of Australia. The information relating to the discovery of petroleum in that territory is of interest. In August 1911, Garnet H. Thomas and Lewis Lett, two engineers in the employ of the British New Guinea Development Company, were on an expedition undertaken with a view of investigating the question of establishing saw-mills, when they discovered a gas spring at Opa, near the mouth of the river Vailala. Previously to this, in June of the same year, E. McGowan and H. Swanson, two gold prospectors, had detected traces of oil in the same neighbourhood, but did not report their discovery to the official authorities until November. Mr. Carne gives the full details of the correspondence relating to these two discoveries. He reviews the previous records relating to the existence of oil and gas in Papua, but he considers the work of Thomas and Lett to constitute the first active incentive to systematic investigation. He proceeds to describe his visit of inspection. He found no oil at the gas wells of Opa and Akauda, where the mud through which the gas escaped was highly saline. He then proceeded to examine an oil seepage to which his attention had been drawn by the natives. This occurs in the bed of a small creek near its junction with the Vailala river. The oil comes from alternating beds of sandstone and mudstone which are overlaid by 10 ft. of alluvium. Plant remains are found in the upper sandstone. The strike and dip of these rocks indicate the limb of an anticline. Shortly afterward another seepage was discovered by Richard Hill about three-quarters of a mile away. The samples collected by Mr. Carne were sent to Sydney to be tested, and the report by the analyst, J. C. H. Mingaye, shows that the light oils are absent; 20.8% consisted of burning oils distilled below 300° C, 74.2% of intermediate and lubricating oils with solid hydrocarbons, and 5% coke. The specific gravity is 0.97. The surface indications at Vailala are not favourable, but it is worth noting that the indications at one of the Sumatran oilfields were no better. The heavy oil is apparently the residuum of a lighter oil from which the volatile constituents have escaped, and it is probable that lighter oils will be found at lower levels, even if not in the bed from which the seepage oil escaped.

THE FUTURE OF THE RAND

Estimates of an independent engineer. Abstract from voluminous report.
A valuable forecast.

By G. A. TROYE.

THE published information regarding the gold-producing companies on the Rand usually consists of a balance-sheet and a review of the last year's operations, supplemented by the chairman's speech. The latter has frequently expressed thoughts that were fathered by a wish, and many past prognostications have proved to exhibit a wide discrepancy with realization.

These notes and statistics aim at a fair and true representation of future probabilities. Although the task of preparing forecasts is beset with the greatest difficulties, and actual reserves are usually but two years ahead of the mill, a thorough and extended knowledge of the industry's past history, the careful consideration of decreasing assay-values with depth, a comparison with results on adjoining properties, in short, an observance of all factors, and above all, an unbiased and well balanced judgment, should enable one to see clearly ahead.

One of the difficult points, over which no control can be exercised, and one that upsets all calculations, is an abrupt change of policy in mining methods. To instance a case in point: The City Deep plant was designed for an annual capacity of about 850,000 tons. In August, 110 stamps crushed 41,500 tons, corresponding to 750,000 tons per annum with the full complement of 200 stamps. Since September 1912, the mine has supplied 150 stamps, reducing the stamp-duty from 15 tons to 11 tons per day, the management contending that finer screening and less tube-milling is more profitable. This contention has, so far, not been confirmed by results, but that is beside the question, the main issue being that a radical change of stamp-duty completely changes all calculations about expected profits and total extent of operations.

Another disturbing element is 'selective' mining, and consequent milling of higher grade ore than the reserves indicate. Apart from upsetting estimates, it may be mentioned that the working costs are correspondingly increased, as is illustrated by City Deep and East Rand results, indicating that the expected advantages are, to a great extent, unreal.

All the valuations are based on a 10% discount factor. This should certainly be a minimum when one can only look a couple of years ahead, for most of the surprises in the older sections of the Rand have been of an adverse nature. To those who prefer to pin their faith to present production as the sole precedent, the statistics will convey a reliable clue.

A list of the dividend-paying companies is appended:

DIVIDEND-PAYING COMPANIES.

	1909	1910	1911	1912
	%	%	%	%
Bantjes	—	—	—	11½
Brakpan	—	—	—	40
Champ D'Or	7½	20	8½	10½
City & Suburban	5	5	11½	15
City Deep	—	—	—	12½
Cons. M. R.	—	8½	8½	5
Crown Mines	—	120	110	110
Durban Roodepoort	55	55	40	25
Durban Roodepoort Deep ...	15	7½	5	10
E. R. P. M.	40	40	30	25
Ferreira	600	300	200	50
Ferreira Deep	52½	55	45	42½
Geldenhuys Deep	—	35	30	15
Ginsberg	25	20	25	32½
Glencairn	10	5	5	5
Jumpers	10	40	40	5
Jupiter	5	—	—	5
Knight Central	—	5	—	—
Knights Deep	30	35	27½	10 (3 mos.)
Langlaagte Estate	20	20	15	15
Main Reef West	25	22½	15	5 (6 mos.)
May Consol	40	40	40	25
Meyer & Charlton	45	45	40	60
Modder B.	—	—	—	20
New Goch	10	15	12½	—
New Heriot	80	80	80	80
New Kleinfontein	25	22½	17½	12½
New Modder	—	21½	25	15 (6 mos.)
New Primrose	55	60	70	55
New Rietfontein	10	10	5	7½
New Unified	20	10	15	20
Nourse Mines	25	20	15	10 (6 mos.)
Princess Estates	20	20	5	—
Randfontein Central	—	—	—	5
Robinson	30	30	27½	22½
Robinson Deep	35	27½	32½	27½
Roodepoort U. M. R.	17½	5	—	—
Rose Deep	25	40	40	45
Salsbury	—	15	5	—
Simmer & Jack	17½	20	15	7½ (6 mos.)
Van Ryn	45	45	45	22½ (6 mos.)
Village Main	70	70	70	70
Village Deep	15	10	10	17½
Vogelstruis Estate	10	—	—	—
W. R. Consols	3½	—	—	—
Witwatersrand (Knight's)	35	35	35	35
Wit. Deep	50	50	35	25
Wolhuter	15	10	15	17½

In estimating the divisible profits likely to be earned hereafter on the Rand, all doubtful factors have been eliminated. The problematical dividend-payers, namely, Jumpers, Main Reef West, New Goch, Luipaardsvlei, Princess Estates, Roodepoort United Main Reef,

Simmer Deep, Vogelstruis Estates, and West Rand Consols have been treated as negligible.

If no untoward conditions arise in 1913 the dividend-earners should pay out £8,550,000.

In 1915 some of the older contributors will be compelled to reduce their distribution. Against this, Geduld, Knight Central, Apex-Benoni, Cinderella Con., Government Areas, Springs Mines, and Van Ryn Deep will gradually enter the list, and it is estimated that the year's result will exceed £8,400,000.

Five years later, in 1920, the City & Suburban, Ginsberg, Glencairn, New Primrose, New Unified, Robinson, and Village Main Reef will either have ceased to exist, or be in their last stages. On the other hand, Apex-Benoni, Cinderella Con., Geduld, Government Areas, Knight Central, Modder Deep, Springs Mines, and Van Ryn Deep should be in full swing. The dividends should approximate £6,000,000 in 1920.

Again, five years later, at about 1925, several more of the old dividend-payers will have to be eliminated from the estimate, namely, East Rand Proprietary, Ferreira Deep, New Heriot, Rose Deep, Simmer & Jack, and possibly Van Ryn. The Modder Deep and new far east Rand companies will make some amends, but dividends will be reduced to about £5,500,000.

In 1930 only seventeen of the present profit-earners will have survived, and their dividends will then total about £4,000,000, to which can be added, at least, £1,000,000 from Cinderella Con., Geduld, Government Areas, Modder Deep, Springs Mines, Van Ryn Deep, and possibly Daggafontein and Cloverfield.

In 1935 about 16 companies will be in evidence; in 1940, about a dozen, among which the Cinderella Consolidated, Crown Mines, Geduld, the mines on Modderfontein, Randfontein Central, and possibly one or two new companies on the far East Rand may be expected still to produce a substantial amount of gold, but it is to be feared that the end will then be in sight.

The foregoing forecast has been deduced from a carefully prepared schedule of all dividend-paying companies year by year, and the aggregates represent a fairly accurate statement of what may yet be expected from the Rand gold industry.

The dividends will probably represent a fifth or less of the total output in the years to come, and the forecast indicates that a score of years hence some £25,000,000 may be expected from the mines annually. This means that the equivalent of hundreds of millions

won from the earth will be put into circulation in South Africa, thus providing the means for expanding agricultural and industrial enterprise. Moreover it is certain that base-metal mining will gradually begin to flourish, and will be directed from Johannesburg. Coal, iron, and notably tin, copper, as also nickel, are bound to become important factors. Of the last-named metal little is generally known here, but prospecting is now in progress on a deposit that looks quite as promising as Sudbury.

Attention may be directed to the apparently drastic view expressed on the future prospects of the East Rand Proprietary. It should be borne in mind that development on the old Angelo Deep, as well as on the neighbouring Knight Central, Simmer East, Simmer Deep, and Jupiter, has consistently revealed abnormally decreasing richness of the orebody as greater depth has been attained. It is also apparent that the East Rand Proprietary will still owe a considerable debenture debt, exceeding one million sterling, when the four original outcrop mines are exhausted; it is to be feared that the position will show no great improvement on the expressed opinion, and the speculative factor will be no more valuable than in the parallel case of the Simmer Deep.

In conclusion, it should be stated that the statistics are taken from the Chamber of Mines records, and are sometimes at variance with the companies' published reports. The discrepancies are, however, insignificant, and do not affect the general aspect.

The accompanying statement gives the life of the principal mines and the share-values as on January 31, 1913. The denomination of the shares is £1, except where noted otherwise.

Mine	Life Years	Share-value Shillings
Brakpan	30	80
City & Suburban (£4)	7	60
City Deep	30	64
Con. Langlaagte	18	42
Con. Main Reef	40	20
Crown Mines (10s.)	30	100
East Rand	5	30
Geldenhuis Deep	25	20
Ferreira Deep	7	60
Heriot	9	90
Meyer & Charlton	17	80
Modderfontein New (£4)	36	230
Nourse	18	33
Robinson (£5)	5	60
Robinson Deep	13	42
Rose Deep	11	49
Village Deep	18	25
Wolhuter	9	17

[The following paragraphs have been selected by the editor out of the mass of calculations and observations made by Mr. Troye in the report to which the foregoing pages served as an introduction.]

Brakpan.—Dip about 8 degrees. A stoping-width of 58 inches brings the tonnage to 25,000 per claim. To check this, the writer has measured all the stopes on the mine-plan completed at June 30, 1912, with a planimeter, and finds that 1,218,770 square feet have been stoped, resulting in a milled tonnage of 528,169. The number of square feet stoped represents 20'9385 claims, and that into the tonnage milled equals 25,225 tons per claim on 13 months' actual results. Allowing 10% off for future contingencies, it is safe to figure on 22,500 tons per claim. On the assumption that 25% of the mine is unprofitable, or left as pillars, etc., the total contents can be estimated at nearly 20,000,000 tons, which, divided by 675,000 tons per annum, equals a life of close on 30 years.

The profit per ton for the 12 months ending June 30, 1912, averaged 11s. per ton. Milling with 160 stamps at the rate of 675,000 tons annually, this equals about 50% on the issued capital. Present developments indicate an

even higher rate of profits, but on results to date the present value of the stock is, on a 10% basis, $\frac{9'42691 \times \text{£}375,000}{750,000} = 94s.$

[Owing to the recent developments, of a less rosy character, Mr. Troye has reduced the estimate of share-value to 80s., as stated in a letter.—EDITOR].

City & Suburban.—Stoping-width on South Reef and Main Reef Leader is 100 inches, dip 32°, percentage of Main Reef stoped during last five years about 25%. Net claim tonnage at 40,000 equals a total of 6,200,000 tons, of which 4,200,000 tons were mined at end of 1911, leaving 2,000,000 tons plus about 25% Main Reef, say 2,500,000 tons in all. On an annual basis of 320,000 tons, the mine's life will extend to 1920.

The present lowest level is 4300 ft. on the incline. From there to the southern boundary is 2400 ft., but the property ends in a point, and an exchange of ground is necessary. At present only 40% of the ore reserve is at-

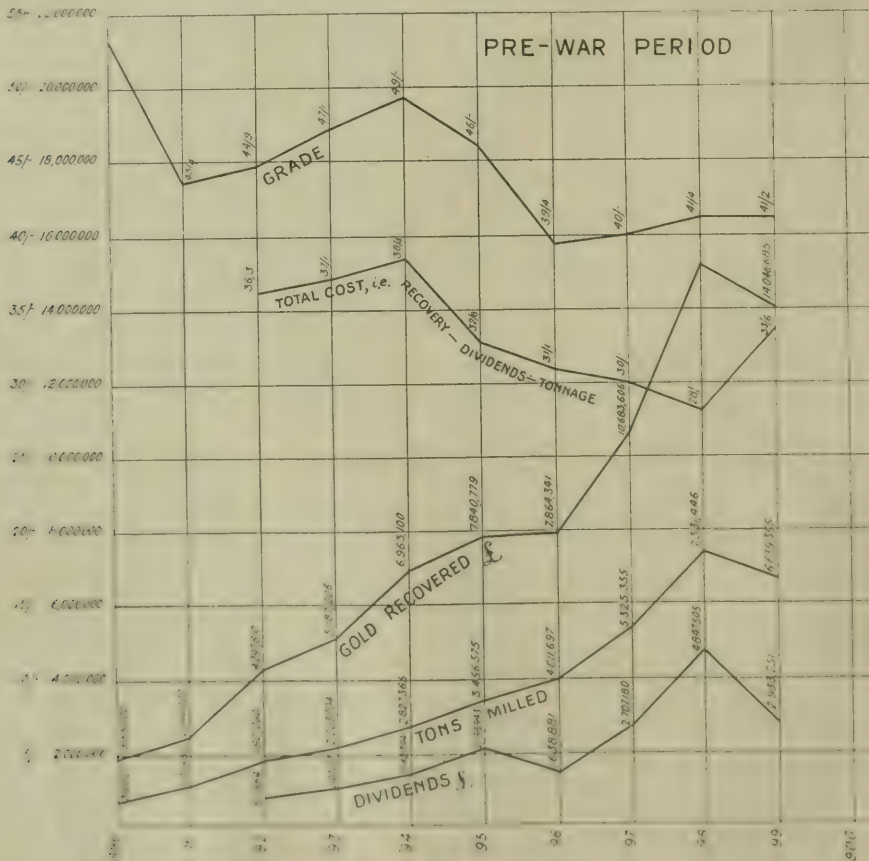
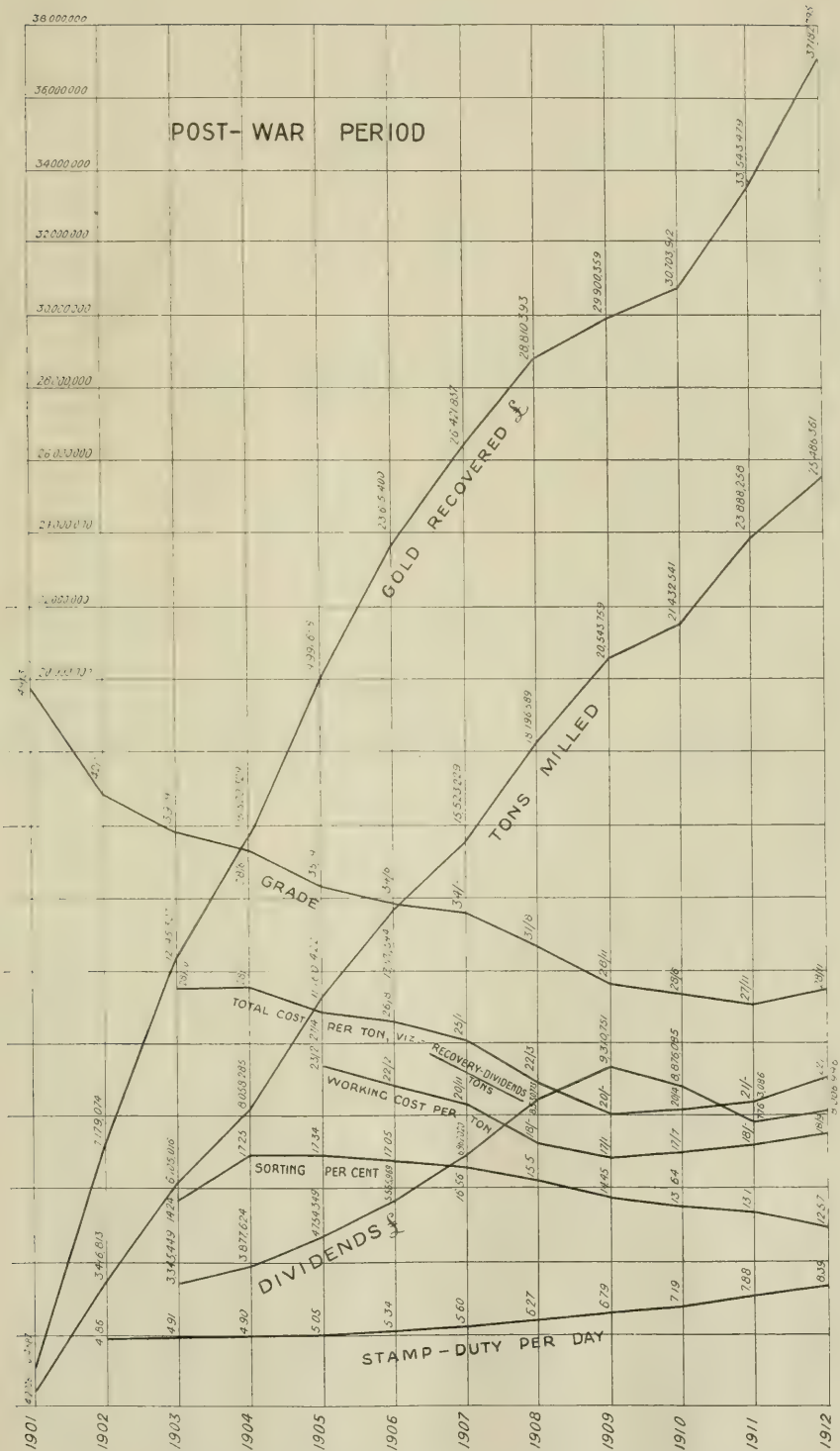


DIAGRAM SHOWING RESULTS ON THE RAND: TONS MILLED.

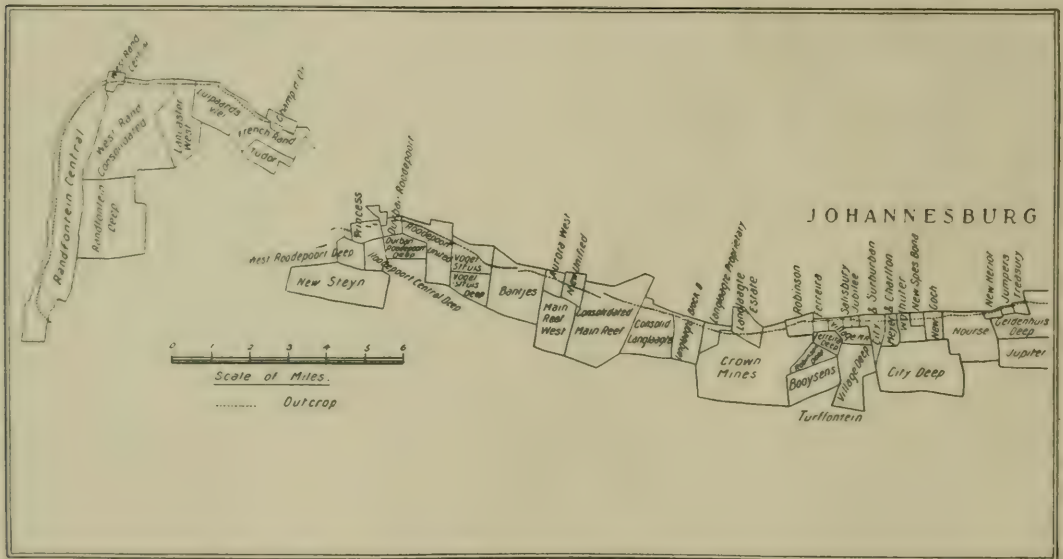


TOTAL GOLD, GRADE, COST, DIVIDENDS, STAMP-DUTY, AND SORTING.

tacked, the balance being obtained from old workings and Main Reef, but this can only last for a part of the mine's remaining life. The profit for six months ending June 30, 1912, is £147,593, but £26,888 of this was gold reserve. Allowing for decrease in grade at lower levels, which is certain, as the ore of the southern neighbour, the City Deep, is of lower grade and averaged 2s. 3d. per ton less for 6 months ending June 30, 1912, than the City & Suburban ore, also allowing for profit-tax, renewals, etc., it is reasonable to assume an average divisible profit of about 60% on 340,000 shares at £1, that is, 12s. for a period of from 7 to 8 years. This, together with the township revenue, represents a present value

as can be seen, the Main Reef Leader is the only profitable orebody. Assuming existing average dip and width, 32,000 tons should be won per claim. Deducting 25% for pillars, faults, and sorting, a nett tonnage of 24,000 per claim remains, equal to a total of 26,000,000 tons on January 1, 1912.

The average grade for 1911 was 31s. 6d., owing to large inclusion of dump ore. Six months in 1912 average 34s. 6d. per ton. The profit averaged 8s. in 1911, and 11s. 6d. in 1912. At present it is 12s. 6d. 110 stamps are now crushing 470,000 tons annually, therefore the present complete plant of 200 stamps should crush 850,000 tons. At that rate, the life will be 30 years, and assuming an average



of 60s. per share on a 10% interest basis on July 1, 1912.

City Deep.—The length of the mine is 9700 ft. on the strike, and south of the Nourse, 11,800 ft. On the dip some 34 levels will be sunk, each having 250 ft. of backs. The average dip is 38°, and the stoping-width 57 in. The mine is operated from two main shafts 4000 ft. apart; the western shaft is 3500 ft. from the boundary. Last year's operations show that 284,000 tons were mined from Main Reef Leader, and only 1500 tons from Main Reef, and 500 tons from South Reef. The reserve at the end of 1911 was 2,080,000 tons of 8.1 dwt. ore, 57 inches wide; of this, 16,000 tons was South Reef. The percentage of profitable ore on the Main Reef Leader was 94.55%; on South Reef only 11.72% proved profitable. These data indicate that, as far

profit of 10s. per ton, after allowance for profit-tax, etc., the present value of 30 annual payments discounted at 10%, amounting to £425,000 per annum, is £4,000,000, and the share value 64s. Given good labour conditions, it is likely that the market will value these shares some 25% higher than the intrinsic merits appear to warrant.

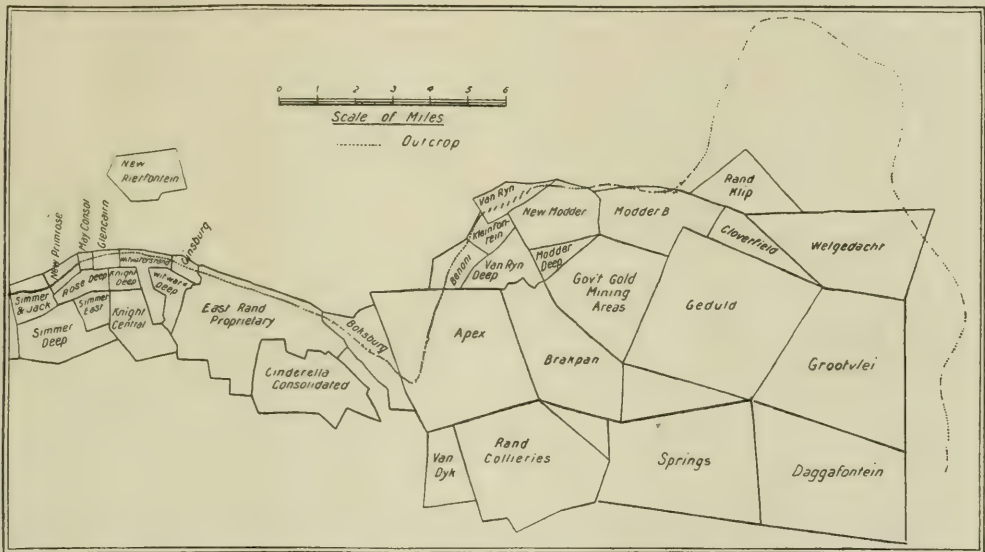
Consolidated Langlaagte.—The number of intact reef-claims is 425 at this date; 8% of this area is north of the dike. The ore reserve at the end of 1911 was 400,000 tons at 5.9 dwt. north of the dike, and 1,220,000 tons at 8.2 dwt. south of the dike. Allowing for machine-stoping, the average ore-width of 47 in. will be exceeded, and the average recovery can be assumed at 29s. At an average tonnage of 23,000 per claim, a total of 9¾ million tons is assured. The new plant will

consist of 100 stamps of 1900 lb. and 10 tubes, capable of dealing with 540,000 tons per annum, and giving the mine a life of 18 years.

The profit for the 3½ years ending June 30, 1912, was £352,800 for 943,500 tons crushed, equal to 7s. 6d. per ton. The profit for the six first months this year averaged 8s. 3d. per ton. With the larger tonnage to be treated, and the much higher grade south of the dike, a better profit can be safely expected, but at only 7s. 6d. per ton, the shares are worth 35s. when discounting the 18 annual dividends at 10%. Every shilling per ton for the 18 years makes each share more valuable to the extent of 4s. 8d., and as it is probable that the profit will fully reach 9s. per ton, the share-value

figure at just under 40,000, or sufficient to meet the anticipated milling capacity of 200,000 tons monthly for a period of 10 years. The 1278 claims south of the dike can be assumed to extend the life an additional 20 years.

The yield since the amalgamation in July 1909 has averaged about $8\frac{1}{4}$ dwt. per ton, but the ore reserve at the end of 1911 stood at 10 million tons of $7\frac{1}{4}$ dwt. ore, a decrease of 0.35 dwt. on the previous year. The general manager draws attention to this by the casual remark: "This falling off was only to be expected." With the increased development of the western and southern areas, the value of the ore reserve is gradually becoming more indicative of the average grade throughout the



may be expected to be 42s. in 1913. It is assumed that the floating debt and outstanding debentures will be redeemed by annual payments of about £25,000, as the Johannesburg Consolidated Investment Co. will only be too glad to retain this safe investment.

Crown Mines.—The haulage of the northern section has been concentrated to two shafts commanding, respectively, the eastern and western sections. About half the ore mined comes from the South Reef. The Main Reef Leader contributes 45% and the Main Reef nearly 6%. The South Reef stoping-width averages 62 in., Main Reef Leader 60 in. The dip in the 615 claims, as yet unexploited, in the northern section, may be taken as 25°. Neglecting the Main Reef, and deducting 25% for unworkable ground, as well as 16% for sorting, the milling tons per claim

property. Assuming an average of $6\frac{3}{4}$ dwt., an extraction of 95·6%, or 27s. 3d., and a cost of 17s. 6d. per ton, a profit of 9s. to 10s., or £1,200,000 yearly, may be expected. Deducting the profit-tax £120,000, debenture interest £50,000, claim rental £20,000, leaves about one million sterling, excluding debenture redemption. At any rate dividends approximating 100% are probable, and the 1,880,212 issued shares valued at £6. 15s. each and aggregating £12,691,430, will earn a profit of 7·88%. On a 10% basis, 30 annual payments of £1,000,000 represent the following present value: $\frac{9'42691 \times \pounds 1,000,000}{1,880,212} = \pounds 5.$

East Rand.—The four original outcrop properties, namely, Driefontein, Angelo, Comet, and Cason, aggregating 851 claims, have furnished practically all the milling ore to date.

The Blue Sky and deep-level areas, that is, Driefontein Deep, Angelo Deep, plus 612 claims south of the same, and Hercules, are of doubtful value. The developments to date show an uncommonly low percentage of pay-ore. A level driven practically from east to west at about 1000 ft. south of the northern boundary showed no single 500-ft. stretch of pay-ore, and again of the 1,679,000 tons developed in the Angelo Deep, only 371,000, or 22%, is reported profitable, and the average of this pay-ore is only 5'6 dwt., the remaining 1,307,000 tons averaging 2'5 dwt. In the Blue Sky, 97% is unprofitable, the limit being taken at 4'3 dwt. over a stoping-width of 55 inches.

Our present knowledge precludes the inclusion of any claim-area outside the four outcrop properties. Past results show that, of 28½ million tons developed, 12½ million tons had been milled, and a reserve of 6,329,000 tons of 7 dwt. ore was in the mine on January 1, 1912. Thus two-thirds of the ore in the outcrop mines has been profitable. The 312 claims worked-out averaged 40,000 tons each; therefore, the reserve and unprofitable ore contents are contained in 349 claims, and 190 claims remained intact in January 1912. Of these, two-thirds or, say, 127 claims, may be regarded as containing 5 million tons of pay-ore, making the total remaining tonnage in the four outcrop mines 11 million tons. Allowing for sorting, the life of the outcrop mines will be five years, when crushing at the present rate.

Disregarding the deep-level area and Blue Sky claims as unprofitable, so far as past investigations indicate, the outcrop properties may be expected to yield an average grade of 31s. 6d., with 21s. 6d. working cost, and a profit of 10s. per ton. The gross revenue will approximate £1,000,000 per annum, from which must be deducted profit-tax £90,000, debenture interest £75,000, debenture redemption from 1914 £100,000, capital expenditure estimated by Ross Skinner at £300,000 for immediate requirements, renewals, depreciation, etc., leaving sufficient for a 30% dividend. When the outcrops are worked out, the company will probably have difficulty in earning sufficient to redeem the debentures and pay interest. The share-value can, therefore, only be legitimately based on the 5 payments of 30%, which, discounted at 10%, is 22s. 9d., and including speculative possibilities, the value is 25 to 30 shillings per share.

New Modderfontein.—The dip varies between 17° and 40°. The ore is from 3 to 9 ft. wide. Past results indicate that the aver-

age contents per claim approximate 23,000 tons. Deducting the 3,512,000 tons milled to December 31, 1912, a balance of rather more than 20 million tons was left intact at that date. On a milling basis of 550,000 tons per annum, this should last till 1950, that is, fully 36 years. It appears reasonable to assume that similar conditions to those existing at present may be maintained. A glance at the statistics reveals the fact that the actual dividends for the past six months are sufficient to pay 9'8% on the market-value of the shares at £12. 16s. 3d. without allowing for amortization. Assuming an average dividend of 30%, or £420,000, for the remaining 36 years, and discounting these annual payments at respectively 8% and 10%, the present value would be respectively £14 and £11. 10s., according to the rate of interest one expects. It is probable that increase of stamping power will yet improve the position, and a 50% profit may readily be earned, at least for a time.

Randfontein Central.—The probable ore is impossible to determine. There are five parallel 'reefs,' all reported profitable, and the life of the mine should be of considerable duration. The last six months' profits were £495,393, against £391,007 for the first six months of 1912, an improvement of £104,387. The ore reserve at the beginning of 1913 is 6,350,780 tons, at 6'8 dwt., that is, an average well above the grade milled in 1912. 752 stamps crushed 2½ million tons, whereas the capacity of the 1000 stamps is over 3 million tons. Taking the year 1912 as a precedent, there appears to be no reason why the future annual profit should fall short of one million sterling. Allowing for profit-tax, loan, and debenture interest, and their redemption, a sum of, at least, £524,212, should be available for distribution at the rate of 12½%. After the loan and debenture liquidation, such profits will of course increase and the shares may be regarded as worth 30s. This valuation may have to be amended when more is known of the future mine development.

Robinson.—It is probable that the Government made a close estimate as to life when fixing the payments of an annuity of £46,576 for 5½ claims as six years from September 30, 1911. The profits will probably continue to decrease, as they are doing now. A rough estimate brings the remaining dividends to £2,000,000, and the period of operations to December 1916. On that basis, the share value is $\frac{3'16987 \times £500,000}{550,000}$, that is 60s. each, with a 10% discount factor.

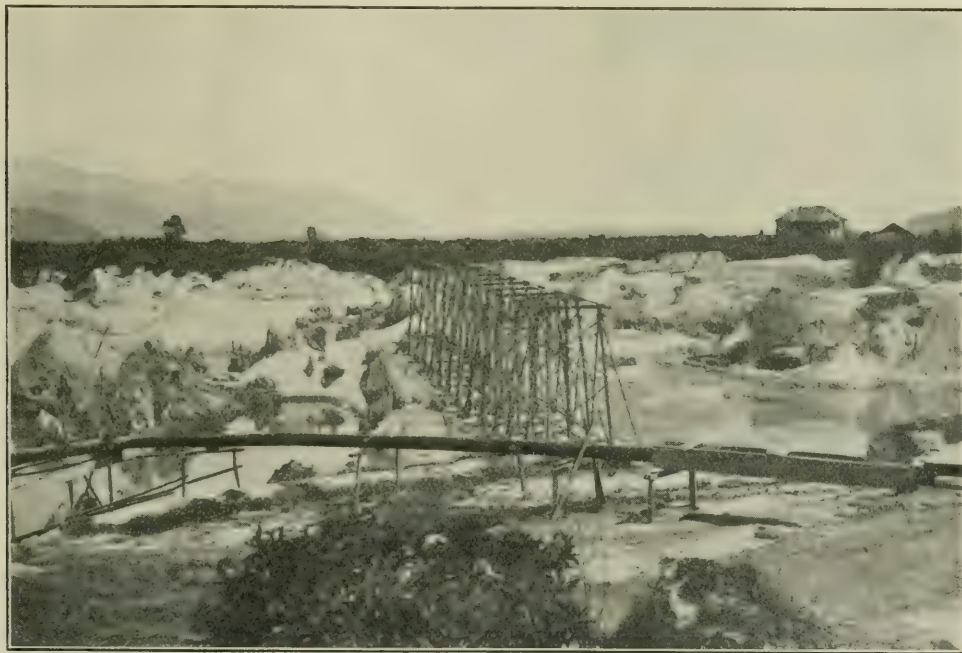
DREDGING FOR TIN IN THE MALAY STATES

A Description of the Steam-driven Pump Dredge at the North Tambun mine, Perak.

By ALEXANDER COLLEDGE

THE working of tin deposits by pump dredging is being successfully conducted in the Federated Malay States, with dredges designed according to Australian and European methods. Though steam-power is usual, some of these dredges use gas engines with gas-producer plants placed on the pontoon; others are driven by electricity. While the gas-driven plant cannot always be recom-

I would draw attention to two recent papers in the *Quarterly Journal* of the Geological Society, Vol. LXVI (1910) and Vol. LXVIII (1912), by the Government Geologist. A careful study of these papers will indicate the conditions and the difficulties governing the successful exploitation of tin gravel. In Perak, the bedrock is almost invariably a hard crystalline limestone of Carboniferous or Permo-



TYPICAL KINTA BEDROCK.

mended, in time, no doubt with due attention to balancing, and to designing suitable pontoons, it will, in most cases, replace steam for the smaller plants. Adoption of electric power usually entails capital expenditure rarely commensurate with the life of a small property. For large undertakings, where several dredges are contemplated, a Diesel-electric scheme with high-tension current taken direct to the barges, would, in spite of the initial cost, perhaps be the most economical arrangement.

The geological features of the tin districts in the Malay States have often been described.

Carboniferous age, and it is usually irregular in form, with sharp pinnacles, which are frequently visible above the ground level. Numerous holes and crevices exist; these are likely to contain cassiterite naturally concentrated. The deposits vary in depth from a few feet to over 200 feet; they contain logs and boulders, and, in most cases, the clay is of varying consistence. The cassiterite is found as worn angular grains varying in size from slime to large cubes. In some cases other minerals, notably wolfram, are associated with the cassiterite. The profitable deposits, locally called

'karang,' are covered with several feet of overburden, which it is generally necessary to remove and treat with the 'karang.' These conditions are unfavourable for the operation of the bucket-dredge, and the sluicing pump-plant seems the only form of dredging that can be adopted.

By the use of powerful hydraulic giants it is possible to break the gravel from the bank and clean the bedrock in an efficient manner. No grab or bucket could reach the crevices or work close to the base of the irregular pinnacles in the same way as the hydraulic jet. Also the clay in its passage down the race to the sump and through the gravel-pump to the sluice-boxes is subjected to attrition and puddling, which tend to liberate the cassiterite.

The deposit of the North Tambun company has a mean depth of 40 feet. There is practically no overburden, and the average content of the 'karang' is approximately 3 lb. tin oxide per cubic yard. The cassiterite is mostly found in a hard blue clay, which makes washing difficult.

Under favourable conditions, that is, moderate depth, friable material, and a good water-supply, the working cost based on conditions as they are today in the Malay States should not exceed 6d. per cubic yard, but owing to the necessity of employing manual labour to break the clay from the bank, it has been impossible to reduce the working cost below one shilling per cubic yard. This includes provision for amortization, and also European supervision. The highest yardage attained is 67 cubic yards per hour.

In commencing operations an excavation, or 'paddock,' was made and carefully levelled, and on this the pontoon and machinery were erected. The deposit is cut from the bank in the usual way by hydraulic giants, water being supplied from a turbine pump. The gravel is washed down a race to the sump, from which the gravel-pump elevates it to the sluice-boxes. Clay that is too hard to remove by the giants is cut out by hand. When necessary to move the plant the paddock is flooded and the dredge floated to a new site, previously levelled. Limestone pinnacles or other obstructions interfering with the free passage of the dredge are blasted and removed. The gravel-pump, in the present position of the plant, works against a total head, suction and delivery, of 75 ft., and the gravel is elevated into a hopper built over a grizzly 14 ft. long and 10 ft. wide, set at an angle of 45°. The grizzly bars are of taper section and the spacing washers give an opening of 1 in. at

the top and 1½ in. at the bottom. Clay-balls and stones are removed on the screen and fall into a steel chute, along which they are carried by a jet of water (obtained from a 3 in. branch in the turbine-pump delivery) to a heap, where they are allowed to weather, and are afterward washed. The undersize from the grizzly falls on to an adjustable baffle, which divides the current equally between two sluice-boxes, each 8 ft. wide and 150 ft. long. Strips of hard-wood each 3 by 2 in. are fitted across the sluice-boxes into grooves spaced about 14 ft. apart. These riffles are built-up as the concentrate accumulates. The sluice-boxes are carried on substantial framing and are made of ¾ in. steel plates. In this country, however, it is better to build these boxes of local hard-wood. The sluice-boxes are streamed-down every three to four weeks, and the concentrate first roughly cleaned in a 'lanchute' (a Chinese contrivance), after which it is finally cleaned in a Willoughby machine. This machine has an action similar to that of a hand-jig, except that no pulsating current is used, a rising current of water being admitted at intervals by a hand-gate.

By making suitable arrangements for returning the water used in hydraulicking, a small amount of outside water is sufficient to make up losses by evaporation and leakage. At the North Tambun mine the water flows through a series of settling-dams and flumes to a final clarifying dam fitted with a pressure-box, to which is attached the suction-pipe of the hydraulicking pump. At this point the water is quite clear and is returned at a pressure of 20 lb. to the pump-suction. This settling system extends over 20 acres. The settling-dams are built in the Chinese style, by tightly ramming alternate layers of coarse buffalo grass (laid at right angles to the line of wall) with clay and earth. The bundles of grass, about 3 to 4 ft. long, are laid on the wall with half their length overhanging; a layer of clay and earth is then tamped on, and the overhanging apron of grass bent over, thus binding the materials into a compact mass. At this mine these dams, probably on account of the hard clay, have given no trouble, but at other mines, where more friable material is used, they frequently give way and cause great expense and inconvenience.

Where it is necessary to fill the paddock behind a dredge, a barrel drain is frequently used. This is usually built of staves and hoops with a rising shaft in the tailing paddock, which is built higher as the tailing accumulates. The top of the drain is built a few



GENERAL VIEW OF NORTH TAMBUN PLANT.



HYDRAULIC GIANT CUTTING THE BANK.

inches above the surface of the tailing, and clear water only is allowed to flow over. By this method no benefit is obtained from any difference in elevation between the point at which the water is returned and the hydraulicking-pump suction.

The gravel-pump is a 12 in. Kershaw centrifugal with a cast-steel three-ported runner fitted with chilled-iron renewable shoes. A chilled-iron liner round the volute and renewable door protect the pump body from wear. Chilled iron for the liners and shoes is found to last longer than steel, and is, of course, cheaper. The feature of this type of gravel-pump is the four-part water-sealed neck-bearing, which is formed within a special chamber bolted to the pump and supplied with clear water under a pressure slightly in excess of that due to the head at which the pump is working. The efficiency of this bearing is apparent from the fact that after a 10-months' run, a close inspection of the brasses showed no wear, and no fresh adjustment was found necessary. A steam primer is fitted to the gravel-pump matching-piece, which enables the pump to be primed in a few minutes.

The hydraulicking pump is a horizontal four-stage Mitchell design, which gives a mechanical efficiency of 70% under full load. The inlet and outlet connections are both 15 in. diameter, and the pressure at the giant nozzles is normally about 60 lb. per sq. in. The centrifugal pumps are connected direct by means of a flexible coupling to a high-speed engine. A duplex externally-packed ram pump, $7\frac{1}{2}$ in. and $4\frac{1}{2}$ in. by 6 in., is connected by pipe to the water-sealed bearings of the gravel and hydraulicking pumps. It is regulated to maintain a pressure of 65 lb. per square inch.

Power is furnished by two high-speed engines of standard type, each capable of developing 240 brake horse-power. The gravel-pump engine is slightly larger than necessary. There are two externally-fired dredger-type multitubular boilers, each 16 ft. long over the tube-plates and 5 ft. 6 in. diameter, with a combined heating-surface of 2630 sq. ft. The fire-grates are constructed to burn wood, or wood and coal, and the boilers have steel-plate casings instead of outside brick-work. These casings are lined with firebrick set in fireclay. The working pressure is 160 lb. per sq. in., and using inferior fuel (Sumatra coal and local undried wood, 6 cords of wood to 1 ton of coal) no difficulty has been experienced in maintaining the full pressure under working conditions.

The lighting plant for the pontoon and sluice-boxes supplies current for 6 arc lamps and 10 clusters of 3 incandescent lamps of 16 c.p. There are also two hand-lamps with flexible cord for night examination work.

The pontoon is 50 ft. long and 40 ft. wide, and has a substantial framework on the outside of 20 by 8 in. timbers. The intermediate cross timbers, which carry the centrifugal pumps and engines, are of 20 by 6 in. section, and the coping round the deck is 16 by 6 in. The floor planking is extra heavy, and the wood used throughout the hull is selected Oregon pine. This wood is not to be recommended where the teredo or kindred insect is encountered, but it seems to last well in the Malay States. The entire hull is rigidly bolted and strapped, and a superstructure of local hardwood, 'chengai,' carries the corrugated-iron roof and housing.

The piping used for the gravel-pump is lap-welded galvanized pipe $\frac{1}{4}$ in. thick with flanged joints. The pump matching-piece has a renewable liner, but beyond this no special provision against wear has been found necessary. The delivery-opening on the gravel-pump is one inch larger in diameter than the suction, to allow of free passage for solids.

The piping used for the hydraulicking-pump is ordinary light-riveted, 18 in. in diameter from the pressure-box to pump-suction, and 16 in. diameter from pump delivery to a distributing branch, which, by suitable matching pieces and 12 in. piping, is connected to the two giants, which both have an intake 11 in. diameter.

The proportion of water to solid material varies. Australian practice indicates 15 to 20 volumes of water to 1 of solid. In the Malay States as high as 25 to 1 is frequently used. At North Tambun the hydraulicking pump is capable of supplying 20 volumes of water to 1 of solid, but this is in excess of requirements. The 12 in. pump under 75 to 80 ft. head gives a mechanical efficiency of 40%. The brake horse-power required for the gravel-pump is calculated from formulas based on the total weight of water and gravel lifted through the required vertical height plus friction, and the mechanical efficiency of the pump. The gravel-pump will handle any stone that can freely enter the suction pipe. The special design of the runner and throat enables the pump to throw up debris without any danger of jamming. A case is on record of a stone 68 lb. in weight and measuring $19\frac{1}{2}$ by 9 by 9 in. being dredged and discharged by a 16 in. Kershaw pump on a harbour-dredge.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

June 1913	May 1913	June 1912
£65. 4s. 6d.	£68. 18s. 9d.	£78. 6s. 11d.

Prices have suffered a further serious relapse, with a decline of £7 per ton. The acute depression in the prices of securities combined with the wide-spread fears of further political complications and of financial stringency, have unfavourably affected quotations, although the statistics continue to show falling stocks and undiminished consumption. The nerves of the world's bourses are in a state of collapse, after months of repeated shocks. Favourable news is invariably disregarded, and every trifling event of doubtful portent is magnified into another blow to trade. During a great part of the month a strike at the Nichols plant has restricted the output of electrolytic copper, but nevertheless the principal refineries have felt constrained to reduce their price to 15 c. in the hope of attracting consumers. Dealers are making still further sacrifices, reckoning confidently on the universal distrust for further concessions, while consumers are buying with reserve. The Nichols strike has given rise to predictions of another decrease in American stocks, but these predictions have been wholly without effect in the market.

TIN.

Average prices of cash standard tin :

June 1913	May 1913	June 1912
£204. 9s. 1d.	£224. 14s. 3d.	£205. 18s. 9d.

The decline which started late in May made steady progress during June, culminating in demoralization at the end of the month. The fall amounts to nearly £30 per ton, and the backwardation which has existed for so many months has been replaced by a contango of about 20s. The decline may go still farther. The principal operators are understood to be clearing out their bull position, preparatory to a fresh campaign, and it is likely to take them some time to turn round. These operations are detrimental to the best interests of the trade. It is just such opportunities as are now presented that should be seized by consumers, for a drop of close on £50 per ton from the top brings the metal down to a price that is cheap, even if manipulation should bring about a further decline. The statistical position at the end of June is quite good, and free buying at the lower level is reported

from both America and South Wales. Sentiment, however, in the prevailing gloom, is not in favour of a higher level of prices.

LEAD.

Average prices of soft foreign lead :

June 1913	May 1913	June 1912
£19. 10s. 8d.	£18. 14s. 3d.	£17. 11s. 8d.

The strength in the market for this metal has continued, culminating in the price of £21. 10s. being repeatedly paid for June delivery. Speculators, however, made some heavy sales late in the month, and drove July lead down to £19, since when the market has reacted to £19. 15s. sellers. We have probably seen the highest of the market for some time to come, but no sensational drop is likely. Demand shows a falling-off, although cable makers are still ready to buy large lines. At the same time the shortage of supplies is likely to become less stringent after July, as the Spanish production should then be again in full swing, and Australian supplies more abundant.

SPELTER.

Average prices of good ordinary brands :

June 1913	May 1913	June 1912
£21. 19s. 10d.	£24. 10s. 4d.	£25. 11s. 11d.

Spelter has continued to fall persistently. Opening at £23 for ordinary brands, by the end of the month the price was down to £20. 7s. 6d. Even now there is little confidence, for although no official intimation of a reduction was made at the last meeting of the convention, it is understood that bids have been accepted from consumers at under market parities. It will be interesting to watch what effect the continuous decline in prices will have on the existence of the convention.

OTHER METALS AND MINERALS.

Prices quoted on July 10 :

SILVER.—27d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £90 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£31 to £33 per ton.

QUICKSILVER.—£7. 10s. per flask.

MANGANESE ORE.—9½d. to 11½d. per unit.

IRON ORE.—Cumberland hematite 26s. per ton at mine. Spanish 20s. delivered.

PIG IRON.—Cleveland 55s. 9d. per ton. Hematite 73s. per ton.

WOLFRAM ORE.—34s. 6d. per unit (1%).

QUOTATIONS

of leading mining shares on the London Market.
Shares are £1 par value except where otherwise noted.
Quotations are given in shillings.

GOLD, SILVER, DIAMONDS.	July 1 1912	June 1 1913	July 1 1913
RAND:			
Barlows	24	22	20
Brackpan	75	78	66
Central Mining (£12)	260	196	182
Cinderella	25	7	8
City & Suburban	52	50	50
Consolidated Gold Fields	80	51	47
Consolidated Langlaagte	23	27	26
Consolidated Main Reef	19	19	17
Crown Mines (10s.)	138	145	136
Durban Roodepoort	23	20	20
D. Roodepoort Deep	23	23	22
East Rand	60	42	50
Ferreira Deep	70	60	60
Geduld	21	24	20
Geldenhuis Deep	38	34	30
Hart	85	72	60
Jupiter	10	10	9
Kleinfontein	28	22	21
Knight Central	13	11	9
Knight's Deep	45	44	45
Langlaagte Estate	23	24	23
Main Reef West	25	10	10
Meyer & Charlton	90	105	100
Modderfontein B	58	76	76
Modderfontein, New (£4)	225	260	247
Nourse	35	36	31
Primrose	38	31	33
Rand Mines (5s.)	132	132	126
Robinson (£5)	95	60	60
Robinson Deep	50	38	33
Randfontein	22	26	27
Rose Deep	68	60	60
Simmer & Jack	22	14	12
Simmer Deep	3	4	3
Springs	15	18	15
Van Ryn	77	77	73
Van Ryn Deep	17	30	30
Witwatersrand (Knight's)	55	72	72
Witwatersrand Deep	51	60	57
Wolhuter	19	17	14
RHODESIA:			
Cam & Motor	32	31	30
Chartered	28	20	19
Eldorado	40	16	17
Enterprise	18	12	9
Falcon	37	17	15
Giant	37	19	10
Globe & Phoenix (5s.)	35	26	27
Lonely Reef	50	57	50
Shamva	70	54	46
Wanderer (5s.)	3	2	2
OTHERS IN SOUTH AFRICA:			
De Beers (£2 10s.)	390	425	430
Glynn's Lydenburg	23	17	16
Jagersfontein	139	140	130
Premier Diamond (2s. 6d.)	190	255	250
Trompsburg	48	52	52
WEST AFRICA:			
Abidjan	8	6	6
Adani	4	17	17
Adani (5s.)	21	20	16
Broomfield (10s.)	4	6	7
Proctor & Co.	20	13	12
Tanah	22	16	16
WEST AUSTRALIA:			
Associated Gold Mines	6	7	7
Associated Northern Blocks	1	19	19
Barlows	11	16	1
Goldfields	69	60	53
Goldfields	39	14	12
Goldfields	4	3	2
Goldfields	1	8	8
Goldfields	81	69	57
Goldfields	59	4	40
Goldfields	3	22	19
Goldfields	13	13	8

OTHERS IN AUSTRALASIA

	July 1 1912	June 1 1913	July 1 1913
Mount Boppy	26	17	12
Mount Morgan	63	68	66
Talisman	43	38	35
Tasmania Gold (10s.)	3	1	1
Waihi	36	37	40
Waihi Grand Junction	22	18	20

AMERICA:

Alaska Treadwell (£5)	165	160	155
Buena Tierra	20	17	17
Butters Salvador	40	50	47
Camp Bird	28	18	14
El Oro	16	14	15
Esperanza	30	19	17
Granville	11	11	11
Mexico Mines of El Oro	135	115	110
Oroville Dredging	5	6	5
St. John del Rey	17	16	15
Santa Gertrudis	30	25	20
Stratton's Independence (2s. 6d.)	2	2	2
Tomboy	25	27	26

RUSSIA:

Lena Goldfields	82	60	57
Orsk Priority	26	15	15
Siberian Proprietary	20	7	5

INDIA:

Champion Reef (2s. 6d.)	11	10	10
Mysore (10s.)	120	102	107
Nundydroog (10s.)	36	24	24
Ooregam (10s.)	17	19	18

COPPER:

Anaconda (£5)	175	145	135
Arizona (5s.)	42	39	38
Cape Copper (£2)	155	120	115
Chilago (10s.)	6	1	1
Famatina	1	1	1
Great Cobar (£5)	90	42	38
Great Fitzroy (5s.)	3	1	1
Hampden Cloncurry	43	43	40
Kyshtin	70	65	60
Messina (5s.)	19	27	29
Mount Elliott (£5)	115	102	95
Mount Lyell	30	23	23
Rio Tinto (£5)	1620	1485	1440
Spassky	80	72	65
Tanganyika	48	45	40
Tharsis (£2)	135	140	135
Whim Well	31	19	15

LEAD-ZINC:

BROKEN HILL:

Amalgamated Zinc	35	32	29
British Broken Hill	60	44	38
Broken Hill Proprietary (8s.)	58	37	35
Broken Hill Block 10 (£10)	50	32	27
Broken Hill Block 14 (25s.)	11	7	6
Broken Hill North	135	49	45
Broken Hill South	170	155	157
Sulphide Corporation (15s.)	25	27	27
Zinc Corporation (10s.)	11	19	17

TIN:

NIGERIA:

Bisichi	20	22	20
Jos (5s.)	5	8	7
Kaduna (5s.)	17	26	20
Nararuta	25	39	36
Nigerian Tin	26	30	28
N. Nigeria Bauchi	6	6	5
Rayfield	19	22	24
Ropp	45	148	147

OTHER COUNTRIES:

Aramayo Francke	28	35	34
Brinsford	8	10	8
Cornwall Tailings	37	27	25
Holmeston	23	19	17
Geopora (10s.)	9	20	17
Geopora	70	32	32
Massachusetts	32	25	20
Reinhold	33	39	35
Tekka	65	65	60
Tronoh	70	73	67

PRECIS OF TECHNOLOGY

Percentage of Recovery from 'Porphyry' Copper Ores.

—In the *Mining and Scientific Press* for June 7, Heath Steele reviews the statistics of yield per ton of copper at the great 'porphyry' mines in the western states, namely, Utah Copper, Miami, Ray, Nevada Consolidated, and Chino, and he compares the figures of estimated content of copper in the reserves with those of the operating results. The tables he gives provide an indication to the investor as to the actual amount reported in the reserve that can be extracted and marketed. The ratio of course covers errors in sampling as well as loss in concentration and smelting. The companies give percentages of recovery based on the assay of mill-feed, concentrate, and tailing, and most of the public and many engineers erroneously apply these figures as a basis for the estimation of refined copper that will be obtained from the estimated gross contents of the reserves. To show that even

particularly in the case of Chino, some oxidized ores have been treated, which accounts for a low recovery. Nevertheless, the fact remains that in 1912, of the 437,899,000 tons of ore reported at the end of 1911 by the Nevada Consolidated, Utah Copper, Miami, and Ray Consolidated companies, and estimated to contain an average of 33.6 lb. of copper per ton, actual milling yielded only 20.4 lb. of refined copper per ton, or 61.4% of that estimated. This is the result of milling 10,809,000 tons of ore. Consideration has no doubt been given by all companies to the possibilities of errors in the estimated contents of the reserves; but whether they have made due allowance is a question suggested by the above facts.

Sulphide Ores of Copper.—The paper by L. C. Graton and Joseph Murdoch, appearing in the *May Bulletin* of the American Institute of Mining Engineers, on 'Some Results of Microscopical Study of the Sulphide Ores of Copper,' will give much food for thought and discussion in connection with the primary

REPORTED IN RESERVE.			OPERATING RESULTS.		
End of year.	Tons of ore reported.	Copper per ton. lb.	During year	Tons of ore treated.	Refined Copper per ton. lb.
UTAH COPPER COMPANY.					
1909.....	90,000,000	35.0	1910.....	4,340,245	19.46
1910.....	203,500,000	33.4	1911.....	4,680,801	19.95
1911.....	301,500,000	30.0	1912.....	5,315,321	17.20
Per cent actual recovery : 1910, 55.6 ; 1911, 59.9 ; 1912, 57.4.					
MIAMI COPPER COMPANY.					
1910.....	18,000,000	51.6	1911.....	445,036	34.40
1911.....	18,232,000	51.6	1912.....	1,040,744	31.50
Per cent actual recovery : 1911, 66.7 ; 1912, 61.					
RAY CONSOLIDATED.					
1910.....	75,096,000	43.4	1911.....	681,519	21.90
1911.....	77,314,000	43.4	1912.....	1,565,875	22.20
Per cent actual recovery : 1911, 50.6 ; 1912, 51.2.					
NEVADA CONSOLIDATED.					
1909.....	29,000,000	40.0	1910.....	2,237,028	28.10
1910.....	40,360,000	34.0	1911.....	3,338,242	23.60
1911.....	40,583,000	33.2	1912.....	2,887,731	21.90
Per cent actual recovery : 1910, 70 ; 1911, 69.5 ; 1912, 66.					
CHINO COPPER COMPANY.					
1911.....	54,970,000	44.8	1912.....	1,122,666	24.70
Per cent actual recovery : 1912, 55.					

those familiar with mining are deceived in this manner, Mr. Steele cites a statement published in the *Boston News Bureau*, on April 13, 1911, to the effect that, allowing for all losses, Miami's ore should yield 37.5 lb. copper per ton. This was when the ore was estimated to contain 51.6 lb. per ton, and would mean a net recovery of about 73%, and, after deducting smelter losses, a mill extraction of about 76.5%. As a matter of fact, the actual net recovery based upon the estimated contents of the ore in reserve has been 66.7% in 1911, and 61% in 1912, when about 5.8% of the total 1911 ore reserve was milled. A mill extraction of 70% means a recovery in refined copper of about 66.5% of the mill-feed, but this figure will make no allowance for an apparent difference in the estimated contents of the ore and the actual results of mining. This difference may be seen in the table.

The percentage of recovery is based upon the estimated contents of the ore reported in reserve at the beginning of the years; that is, the net recovery in 1912 is figured against the average contents reported at the end of 1911 for the ore reserve. In some cases,

and secondary nature of the various ore deposits. By a long series of microscopical examinations they have found that in the great majority of cases the type of structure will show whether a sulphide is primary or secondary. An important statement is that in no case has a secondary sulphide been observed developing except by replacement of another sulphide mineral. Their proofs that bornite and chalcocite are more often primary than secondary are subversive of the general opinion that these minerals are nearly always secondary, and will obviously delight the owners of deposits of these minerals. The following minerals of copper or associated metals are considered invariably primary: pyrite, pyrrhotite, tetrahedrite, tennantite, sphalerite, and galena. No mineral is invariably secondary. Of the sulphides developed secondarily, chalcocite is by far the most common and abundant; covellite is common, but not usually present in large amount; chalcocyanite is not uncommon but rarely abundant; bornite is rare and generally sparing in amount; and enargite is uncommon and insignificant in quantity. The circumstances determining the secon-

dary production of these minerals are discussed by the authors. The paper is lengthy, containing 76 pages and many micro-photographs, and it gives in great detail the reasons for arriving at the conclusions mentioned above.

Steel for Rock-Drills.—The Mines Trials Committee, of Johannesburg, has published a pamphlet containing a report of investigations on rock-drill steel made by Robert Allen. The object of the investigation was to determine the most suitable steel for use on the Rand and to standardize its heat-treatment.

The steels tested were all of sizes suitable for use with small-piston machines. The drills were standardized with regard to their length and to the shapes of the bits. Drawings of the latter accompany the report and are reproduced herewith. The steels were classified according to the weight lost in drilling, to the loss of reaming efficiency, and to the general appearance of the bits after use.

It was formerly accepted as an axiom that high-carbon steels were the most suitable for rock-drills, but Mr. Allen claims that while both these and alloy steels require a more complicated heat-treatment, their drilling results were no better than those of the ordinary medium-carbon steels. Low-carbon steels were eliminated for obvious reasons, and from the ordinary medium-carbon steels were eliminated those that possessed undesirable tendencies, such as flaking, chipping, splitting, undue wear, or if they were generally treacherous. From the analyses of the most efficient steels remaining were deduced formulas for the compositions of the most suitable steels for rock-drill purposes. In these formulas the carbon content varies inversely with the size of the steel as follows, this being one of the most interesting discoveries of the investigation :

Size of Steel	Percentage of Carbon
(a) Larger than $1\frac{1}{2}$ in. cruciform, or steel weighing more than $5\frac{1}{2}$ lb. per foot run.....	From 0'60 to 0'65
(b) $1\frac{1}{2}$ in. cruciform, or steel of equivalent weight.....	From 0'64 to 0'69
(c) 1 in. octagonal.....	From 0'67 to 0'72
(d) $\frac{7}{8}$ in. octagonal.....	From 0'70 to 0'75

The quantities of silicon, phosphorus, sulphur, and manganese recommended are the same for all sizes of steel, and are as follow : silicon between 0'05 and 0'15% ; manganese between 0'25 and 0'35%, the total manganese and silicon content not to exceed 0'40% ; total phosphorus and sulphur not over 0'035%, the less the better ; alloying element none, except that aluminium might be used as a purifier so long as, in the finished steel, the amount did not exceed 0'10%.

As there appeared, from the experiments, to be no practical difference between steels of the same chemical composition, whether made by the open-hearth, the crucible, the Swedish Bessemer, or the electric crucible processes, the method of manufacture was optional. Hammered (or tilted) steel showed no superiority over rolled, therefore for rock-drill purposes the expense of hammering might be avoided. For the heat-treatment in the forging and sharpening of drill-bits, oil furnaces were found to be superior to coal forges, and an oil-furnace, specially designed by

Mr. Allen, was found to give better results. We intend to give details of this furnace in a later issue.

The steels of the compositions recommended above can be heat-treated in a comparatively simple way, which makes a separate tempering operation unnecessary. This method is recommended, and is here given *in extenso* :

(1.) The drills, properly cleaned, are heated to an orange-red heat, at about 1050°C ., this heat extending a short distance along the drill from the cutting edge about $1\frac{1}{2}$ in. for a hand drill, 2 in. for a medium-sized machine drill, and 3 in. for a large machine drill.

(2.) The heated drill is then forged by rapid hammering and dollying until it has reached a dull red colour—about 600°C .—the work proceeding as quickly as possible. This operation for a medium machine bit should take from about 45 to 60 seconds.

(3.) The bit, without letting it cool further, is put back into the furnace and re-heated to a bright red colour—about 950°C .—the heat extending along the bit the same distance as before.

(4.) It is then sharpened and made to gauge, the hammering proceeding strongly and rapidly, until the bit has reached a cherry red colour—about 750°C .—the colour extending, in the case of a medium machine bit, to about the line A B shown in the accompanying drawings, when it is quenched. This operation with a medium machine bit—in the hands of a good tool-smith accustomed to gauging—will take about 45 seconds. Bits made of $1\frac{1}{2}$ in. cruciform steel or larger should be quenched by standing them vertically on a knife-edge support in the water in the quenching bath, so that the drills stand in from $\frac{1}{4}$ to $\frac{1}{2}$ in. of water. Smaller bits may be quenched by plunging them vertically into the water, and keeping them moving around in a vertical position for 5 or 6 seconds, and then standing the drills on the false bottom of the quenching bath and leaving them there until they have become of the same temperature as the water. The removal of a drill from the quenching bath before it is quite cold is liable to produce fracture.

Mr. Allen gives the dimensions and arrangements of a suitable quenching bath, and he recommends the use of a thermo-telegraph mercury thermometer to help in the regulation of the temperature of the water in the quenching bath, the indicating dial attached being graduated from 0° to 40°C . The success of the sharpening operations depends very much upon this piece of apparatus.

The standardization of the shapes of bits, and the gauging of the bits in both directions, when sharpening drills, are considered important. The expense of sharpening is slightly increased, but this is offset by many advantages: the rate of drilling is increased ; the miner's waste of time in selecting drills that he thinks will follow one another properly (but often don't) is avoided ; the chance of 'fitchering' or deflection of a drill by 'slips' in the rock is reduced ; also, when the reaming is good, the drill-holes can be drilled more cylindrically and explosives used more economically.

All the bits used during the experiments were made and sharpened by hand, and it is to be regretted that the investigations did not embrace experiments in the use of machine-sharpened drills, which are automatically gauged.

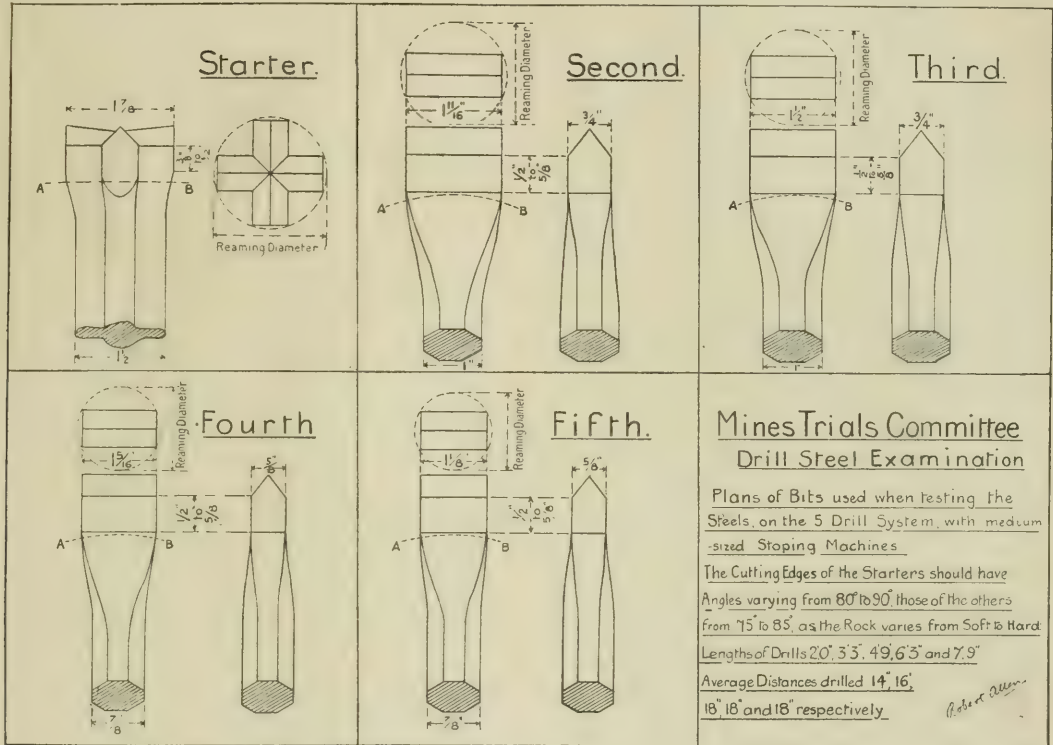
It is pointed out that by close attention to what are usually considered trivial matters many economies can be gradually effected. When the steel is of suitable composition, lighter drills can be used to bore holes of the same depth ; this, in turn, allows the use of

lighter drilling machines; less steel has to be handled and sharpened; less compressed air is needed.

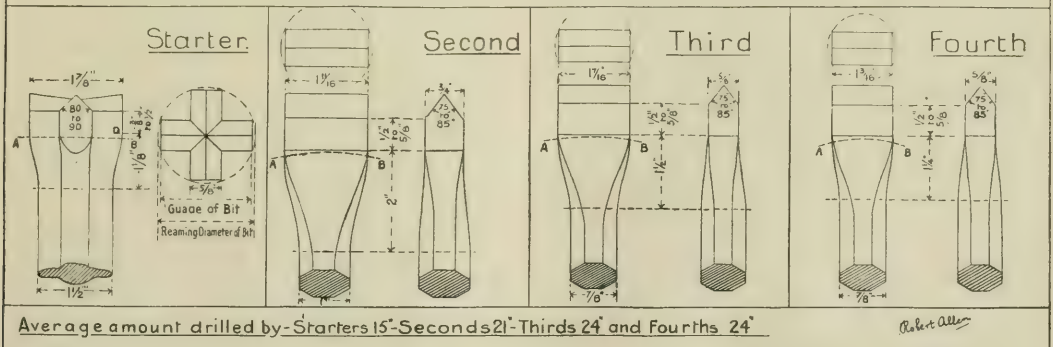
Incidentally, it might be noted that the use of lighter drilling machines lessens the number of machine-boys required.

The report contains a number of appendices giving definitions of technical terms used, notes on the heat-

Antarctic Minerals. — The *Australian Mining Standard* for May 1 contains a summary by T. W. Edgeworth David of the geological information obtained by Douglas Mawson's expedition to Antarctic regions. Adelie Land consists for the most part of a huge ice-covered plateau, rising sharply from the coast-line to a height of over 7000 ft. At Common-



Plans of Bits used with medium sized Stopping Machines for testing the Steels



treatment of drill steel, drilling results obtained when testing the steels, remarks on the influences on steel of various chemical elements, dimensions for the best sections for cruciform steel, data obtained by mechanically testing some of the steels, and the method recommended for the sampling of parcels of drill steel for analysis.

wealth Bay, Dr. Mawson's headquarters, the shores are formed of outcrops of ancient schist and gneiss, but the ground does not rise to any great height here. At another point a sea-cliff was found 1000 ft. high, the upper part of which has the appearance of a volcanic and the lower half of bedded sandstones and coaly shales containing fossil plants. This deposit no

doubt formed part of the great antarctic coalfield, which has now been proved for a distance of 1500 miles. The bands of coal were ascertained to be from 3 to 7 ft. thick, and the specimens sent to Sydney indicate that the quality is good. Near Dr. Mawson's camp, copper ore was found. The pebbles of the glacial moraines contained carbonates of copper, and their source was traced to an outcrop of quartz veins. These veins also contained stibnite and molybdenite. In the schist and gneiss, crystals of garnet and emerald appeared to be plentiful, and some of them of value as gem-stones. As far as the report goes, the copper deposit does not seem to be of great importance, but the coal has a distinct promise; it is of special interest now that the coal deposits in the arctic region at the opposite pole are being worked.

Rand Ore-Reserves.—The *South African Mining Journal* for May 24 gives its annual estimate of the ore reserves at the mines on the Rand on December 31 last. The total is 87,387,462 tons, as compared with 82,682,685 tons the year before. This does not include the partly developed ore reported by several companies, nor does it take cognizance of the few mines outside the control of the big groups. Of course it does not include the so-called ore of unprofitable grade that looms large in some of the company reports.

	Tons.	Dwt. per ton.
CENTRAL MINING & INVESTMENT :		
Bantjes Consolidated	840,800	7'0
City Deep	1,914,540	8'7
	209,110	8'6
City and Suburban	773,300	8'4
Crown Mines	10,607,670	7'1
Durban Roodepoort Deep.....	965,300	6'7
	340,800	7'3
Ferreira Deep	2,070,900	9'4
Geldenhuis Deep.....	1,904,700	6'3
Modder B.....	2,594,000	7'2
New Heriot	590,742	8'1
New Modder.....	3,900,000	8'1
Nourse Mines	1,969,000	6'6
Robinson	1,130,600	11'0
	242,500	
	1,160,800	4'3
Rose Deep.....	3,695,100	6'1
Village Deep.....	2,235,300	6'9
Village Main Reef	1,418,754	8'8
	38,563,916	

CONSOLIDATED GOLD FIELDS :		
Jupiter	1,270,000	4'4
	101,000	4'0
Knights Deep	1,477,414	4'47
Robinson Deep	1,114,000	6'7
Simmer & Jack	2,680,000	6'2
	438,000	5'3
Simmer Deep.....	1,430,693	4'2
	144,295	4'08
	8,655,403	

EAST RAND PROPRIETARY MINES :		
East Rand Proprietary	6,013,000	6'8

ANGLO-FRENCH EXPLORATION :		
Apex	496,438	6'18
New Kleinfontein.....	1,190,663	7'59
	1,687,101	

CONSOLIDATED MINES SELECTION :		
Brakpan Mines.....	2,457,000	6'74

GENERAL MINING & FINANCE :		
Aurora West.....	556,163	5'1
Cinderella Consolidated.....	573,000	6'7
	304,000	
Meyer and Charlton	341,745	12'0
New Goch.....	957,600	5'1
Roodepoort United.....	379,283	5'08
	100,000	6'34
Van Ryn	2,064,500	6'42
	89,365	5'24
West Rand Consolidated.....	1,116,733	6'02
	326,500	
	6,808,889	

SIR J. B. ROBINSON :		
Langlaagte Estate	1,370,639	
Randfontein Central	7,600,000	6'2
	8,970,639	

JOHANNESBURG CONSOLIDATED :		
Consolidated Langlaagte	2,069,630	6'4
Ginsberg	346,681	6'9
Glencairn	761,000	3'5
New Primrose	413,033	6'5
New Rietfontein	135,887	6'5
	130,107	
New Unified	275,028	6'4
Witwatersrand	1,331,540	6'1
Van Ryn Deep.....	1,278,003	7'1
	6,740,909	

S. NEUMANN & Co. :		
Consolidated Main Reef.....	610,680	7'2
Main Reef West	685,720	6'3
Knights Central	647,000	6'1
Wit. Deep.....	1,492,257	6'83
Wolhuter	832,977	6'48
	4,268,634	

A. GOERZ & Co. :		
Geduld Proprietary.....	1,475,000	6'98
	116,000	5'79
Lancaster West	335,500	6'1
May Consolidated	133,000	6'64
	25,000	8'49
Princess Estate.....	637,000	7'24
	2,721,500	

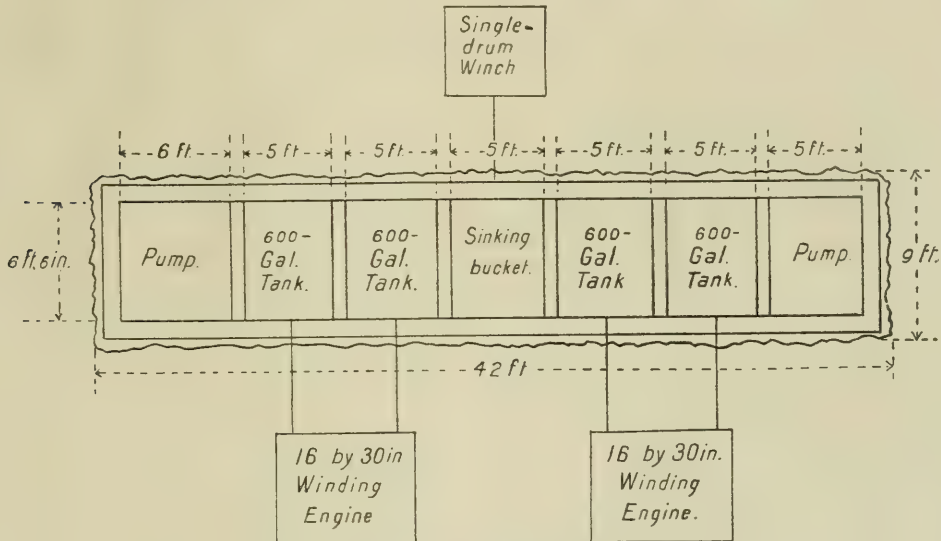
L. EHRLICH & Co. :		
Luipaardsvlei Estate	500,471	5'7

Experimental Production of Coal.—At the May meeting of the London section of the Society of Chemical Industry, F. Bergius described experiments resulting in the production of coal from cellulose and peat. It is usually assumed that coal is formed by the slow oxidation of cellulose. Any experiments hitherto undertaken, using high temperature and pressure so as to accelerate the reaction, have failed because the exothermic action has liberated the heat so rapidly that the material has been immediately coked. Mr. Bergius found that a temperature of 300 to 350° C. was desirable, and he sought for means of preventing the temperature rising above this. Ultimately he found that if the process was conducted in water, the specific heat and the conductivity of the latter were sufficient to absorb and remove the heat of the reaction. Under these conditions, the cellulose was decomposed into a black powder, averaging 84% carbon, 11% oxygen, and 5% hydrogen, water and carbonic acid being

liberated. In studying the range of temperatures at which the reaction takes place, he found that at 310° C. the change was completed in 64 hours, and at 340° C. in 8 hours. He deduces from these figures that the time occupied in the production of coal by the oxidation of cellulose doubles with every decrease of 10° C. in temperature. Thus at ordinary atmospheric temperature, 10° C., the time would be 8 million years.

Shaft-Sinking at Springs Mine.—At the May meeting of the Institution of Mining and Metallurgy, a paper by B. D. Bushell was presented, but not read, describing the sinking of the North shaft at the Springs mine in the far east Rand, more particularly in connection with the removal of the water during sinking. Water was first struck in the dolomite belonging to the Black Reef Series at a depth of 459 ft., and the fissure extended to 605 ft., where the Witwatersrand

below the dolomite. The rings were connected by pipes to carry water downward to the lowest one. In making a ring, a wooden bottom was fitted carefully from the outer edges of the wall-plates to the walls and ends of the shaft between the blocks. Deal baulks, 9 by 3 in., planed and blanketed, were placed on edge right round the shaft, flush with the inner sides of the wall-plates and end-plates, and the space between the deals and the shaft-walls was filled with concrete to the top of the deals. Similar deals were then built up on edge to the height of the next wall-plate above, thus forming a tank all round the shaft about 5 ft. deep. The sides of the tank were fitted with two 8-in. sluice-valves at each compartment, containing a bailing tank. During blasting the pumps were stopped, and afterward 6 hours were occupied in freeing the bottom of the shaft from water before the men could go back to work.



PLAN OF SHAFT AT SPRINGS MINE.

quartzite was reached. The inflow averaged 2 million gallons per day while sinking through the dolomite. Once below the fissure, no additional water came in, and in fact the amount of water entering was reduced. The methods of dealing with the water could therefore be divided into two periods. The total depth of the shaft is 3432 ft. The shaft measures 42 by 9 ft. overall, and is divided into seven compartments, six of them measuring 6 ft. 6 in. by 5 ft. inside timbers, and the seventh 6 ft. 6 in. by 6 ft. During the first period the shafts were used as shown in the illustration. A wooden headgear was erected over compartments 2 to 6. Two winding-engines were used for hoisting bailing-tanks in compartments 2, 3, 5, and 6, each tank having a capacity of 600 gal. A single-drum winch hoisted broken rock through compartment 4. Two Worthington pumps were lowered down compartments 1 and 7 respectively. They rested on the bottom timbers, and their suction-pipes could be removed and raised for blasting. These pumps were used for raising water from the shaft bottom to a 'ring,' whence it was bailed to the surface. Their head was 30 ft., so as the depth increased new rings had to be built. Altogether 6 rings were used, from 450 ft. to 619 ft., the lowest eventually delivering the water to the permanent sump

During the second period of sinking, through the Witwatersrand Series, from 605 ft. to 3432 ft., the arrangement was altered so as to afford greater hoisting capacity for broken rock, and eventually two permanent electric pumps were used for raising the water from the sump at 654 ft., 35 ft. below the bottom ring.

Spontaneous Combustion of Coal.—At the meeting of the Institution of Mining Engineers held on June 5, M. E. E. Lamplough and A. Muriel Hill read a paper detailing their experiments on the spontaneous combustion of coal-dust, and giving the results of their investigations. The work was done in the laboratory at Cambridge at the suggestion of Dr. J. S. Haldane, who had been asked to advise on 'gob-fires' by the Doncaster coal-owners. For many years the presence of iron pyrite in the coal seams was supposed to be the cause of the firing of the coal, owing to the heat given off during its oxidation. More recently the absorption of the oxygen of the air by the carbonaceous matter itself was shown to be a cause of heating. Since then the relative influence of these two agencies has formed a continuous topic of discussion. The general opinion nowadays is that the heat evolved by the pyrite is not in itself sufficient to start combustion, but that at the increased temperature thus caused the absorption of

oxygen is greatly increased. The writers of the paper were the first to examine the question systematically and to measure the heat evolved under the two conditions. Their method should provide a means of ascertaining the probable behaviour of coal in new mines. We give herewith their general conclusions:

(1) The heat which was evolved when coal-dust was heated in an atmosphere rich in oxygen in the authors' experiments, was nearly proportional to the volume of oxygen absorbed, the mean value being 3.4 calories of heat produced during the oxidation brought about by the absorption of 1 cubic centimetre of oxygen.

(2) The production of heat may be attributed to two chemical changes, namely, the oxidation of iron pyrite and the oxidation of carbonaceous matter.

(3) The oxidation of carbonaceous matter in coals practically free from iron was not so rapid as in those containing much iron, but continued for a long time, comparatively little carbon dioxide being evolved, so that eventually there was considerable heat evolution even in the absence of ventilation.

(4) The oxidation of iron pyrite was at first very rapid, but soon almost ceased, because the flask became choked with carbon dioxide, which prevented further admission of oxygen. With conditions under which there is diffusion of air through the coal-dust, and when a considerable amount of iron pyrite is present, the oxidation of this mineral would possibly be the predominant factor in the spontaneous heating of coal-dust.

(5) Oxidation of coal-dust takes place in contact with gas containing much less than the normal proportion of oxygen present in air.

(6) The oxidation of carbonaceous matter and the total changes occurring in pyrite during the absorption of a given volume of oxygen produce about the same amount of heat, so that the rate at which heat is given off in the oxidation of coal-dust due to either process may with surprising nearness be determined by the volume of oxygen absorbed.

Aluminium Conductors.—At the June meeting of the Institution of Mining Engineers, Burckwood Wellbourn read a paper on the comparative advantages of aluminium and copper cables used for the transmission of electric current, with special reference to mining work. As the author says, copper is a reliable metal, and the physical, chemical, and electrical phenomena connected with it are well known. Therefore the natural tendency is to keep to it and not experiment with any other metal. Nevertheless there is no reason why insulated aluminium conductors should not be used for all purposes and at all working pressures provided the relative prices permit. As regards bare conductors, the possibility of various substances coming in contact with the cables has to be considered. For instance, in the neighbourhood of smelting-works or coke-ovens, where sulphur compounds are in the atmosphere, aluminium has an advantage over copper; on the other hand bare aluminium ought not to be used where hydrochloric acid or alkaline solutions are likely to be present. In comparing the quality of the two metals, the electrolytic copper-wire bars contain an average of 0.2% of impurity. The aluminium bars usually contain 0.5 to 0.7% of impurity, chiefly silicon and iron. Aluminium with 0.71% impurity has a conductivity only 60% of that of copper of equal section. So the diameters of wires of equal conductivity are 1.29 for aluminium and 1 for copper. Copper has a specific gravity 3.3 times that of aluminium, and the weights of wires of equal conductivity are 2 for copper to 1 for aluminium. Thus the total weight to be supplied in connection with overhead transmission is

much less with aluminium than with copper, but on the other hand the greater diameter of the aluminium wire offers a greater surface for radiation, for the accumulation of snow, and resistance to wind pressure. The greater diameter of aluminium also has the disadvantage of requiring a greater amount of insulating material. Aluminium expands more than copper when heated, the coefficient of linear expansion per degree Fahrenheit being 40% greater. Provision has therefore to be made for expansion in the case of insulated conductors. The relative tensile strength of the two metals has to be considered in connection with overhead conductors. Aluminium wire can be produced by cold-rolling with nearly as great a tensile strength as hot-rolled copper wire, but it has only half the strength of cold-rolled copper.

Insulated aluminium cables have not so far been used in mines in Great Britain, and they have only been used to a limited extent in connection with electric lighting stations. In France, Germany, and Switzerland, they are used extensively in electric lighting and tramway work. With regard to the relative cost, Mr. Wellbourn gives details of various types of cables, lead-sheathed, armoured, etc., and he finds that with double-wire armoured cables the price of aluminium per ton must be less than that of copper before aluminium can be used in preference to copper. With plain lead-sheathed cables, aluminium can be profitably used if its price is not more than £22 per ton more than that of copper.

On the other hand the first cost of an overhead transmission system is cheaper with aluminium than with copper. The author gives the following comparative estimate of an installation of 6600-volt., 3-phase, 25-cycle line to carry 1000 kilowatts for 10 miles:

	Copper.	Aluminium.
Strand	7/0 136	12/0 134
Span, in feet	200	200
Summer sag, in feet	3.6	4.8
Ground clearance, in feet	22	22
Distance apart of wires, in feet	3	4
Height of pole above ground, in feet	29	32
Depth of pole in ground, in feet	6	6
Total length of pole (taking standard size), in feet	36	38
Number of poles per mile	27	27
Diameter of single poles at 5 feet from butt at 17 pounds per square foot wind-pressure and factor of safety of 8 for poles, $\frac{3}{8}$ for copper, and $\frac{1}{2}$ for aluminium, in inches	11 $\frac{1}{2}$	12 $\frac{1}{2}$

The cost of materials and erection per mile of the above line with wires and brackets would be as follows:

	Copper.	Aluminium.
	£ s. d.	£ s. d.
27 creosoted wooden poles with brackets and insulators	127 10 0	145 15 0
3 miles of conductors erected (copper, 6330 pounds; aluminium, 3210 pounds)	287 10 0	199 10 0
Total cost ..	£415 0 0	£345 5 0

This shows an approximate saving of 16.5 per cent in favour of aluminium.

The author remarks that a greater clearance between wires is required with aluminium than with copper, for on account of their less weight the wind blows them up and down as well as sideways. He also warns against the use of welding in connection with aluminium conductors, and recommends mechanical joints, of which he describes several types.

Sintering at High Altitudes.—In our issue of October 1910, we gave a lengthy abstract of a valuable paper by R. L. Lloyd on the behaviour of blast-furnaces at high altitudes, with special reference to the experience at Cerro de Pasco, Peru, 14,000 ft. above

sea-level. Mr. Lloyd has contributed an article on the behaviour of the Dwight-Lloyd sintering machine at the same place, in the *Mining and Scientific Press* for June 14. The results obtained have shown that sintering by this method at high altitudes is confronted by no more serious problems than are experienced in blast-furnace smelting at the same altitudes. At such altitudes as 14,000 ft. there is always some difficulty in kindling a fire of any kind, and any burning material tends to go out if the conditions most favourable to combustion are not maintained. As was to be expected therefore, a sinter bed is not quite as readily ignited at Cerro de Pasco as at lower altitudes, but no serious difficulty was experienced in this regard; the ignition flame was simply made a little more intense, a condition readily attained with the crude-oil burner that was used. The ore charges treated were in all respects similar to the copper charges treated elsewhere, except that the sulphur content was higher than usual (25%). With such a sulphur tenour, considerable difficulty is generally experienced at lower altitudes, on account of the excess of the heat of combustion of the charge, but at an altitude of 14,000 ft. no difficulty at all was met. This was probably because of a tendency toward slower combustion, it being remembered that a cubic foot of air at 14,000 ft. contains only about 60% of the oxygen that a cubic foot of air contains at sea-level.

As is well known, sulphur is sometimes produced while sintering, and is carried through the fan with the gases as flowers of sulphur. At lower altitudes, if the exhaust gases are quite hot, the sulphur sometimes tends to collect in the fan, and if not cleaned out at regular intervals may take fire. No such difficulty was experienced at Cerro de Pasco, and although the sulphur appeared in the fan and was cleaned out at regular intervals, there never seemed to be any tendency to take fire, probably because of the low oxygen tenour of the atmosphere. No attempt was made at Cerro de Pasco to find the low sulphur limit for sintering, as the problem was to work the highest sulphur charges possible, and while it was proved that 25% was an entirely feasible charge at that place, it is not yet proved to be the maximum permissible.

The speed of sintering was rather surprising, and seemed to be almost if not quite equal to that at lower altitudes. This he considers to be, partly at least, due to the large amount of sulphur driven off in the elemental state, as the ore contained much pyrite. It is hard to get an exact comparison of speed, however, as no such high sulphur charges are being worked elsewhere by this method. The power consumption per ton sintered was practically no greater than that used at ordinary altitudes, and the ordinary vacuum of 4 to 6 oz. per square inch was found to be entirely satisfactory.

Sintering by the Dwight-Lloyd system had been previously tried at Cerro de Pasco, in a plant erected in 1907 under an arrangement with the patentees, but designed independently. The plant was of the intermittent 'pan' type, and proving unsatisfactory was eventually abandoned. The cause for this failure is entirely clear when the mechanical difficulties of properly placing a sinter bed on an apparatus of the pan type, and of re-establishing the best working conditions for every batch are realized. Such difficulties do not exist while practising the continuous system of sintering as is now satisfactorily employed at Cerro de Pasco and many other places. Steps have been taken to enlarge the existing plant at Cerro as rapidly as possible, so as not only to eliminate fine-ore troubles, but also to get the great increase in smelting speed which follows the addition of sintered material to the charge.

Rhodesian Geology.—The second yearly report of the Geological Survey of Rhodesia contains remarks by the director, H. B. Maufe, on the classification of the metamorphic rocks and the association of gold with them. As a result of the detailed work recently undertaken in connection with these rocks, it is becoming increasingly clear that they are divisible into three series, one of which consists of three groups: (a) a greenstone-schist group, including epidiorite, (b) a banded ironstone, and (c) a conglomerate and grit group. These are at present largely lithological groups, and will probably require sub-division. The second series consists of ultra-basic rocks, some of which contain chromite and asbestos. The third series comprises a variable group of fine-grained and frequently schistose acid rocks, which have not hitherto been recognized as a distinct series. The recognition of these three series into which the metamorphic rocks may be divided, coupled with a consideration of the distribution of gold-bearing quartz lodes and the mode of occurrence of an important class of auriferous impregnations, has led up to what is probably the point of greatest practical importance resulting from the year's work, namely, that the gold deposits of the territory are closely associated with the last-named series of acid igneous rocks. The statement rests at present on a general impression created by the field evidence, but the experience has been repeated so often that chance seems to be excluded. From some points of view it would be preferable to wait until the evidence can be presented in a complete form, but, as the subject has a direct bearing on prospecting, it is deemed advisable to draw the attention of prospectors and mining engineers to it at once. For if, as it seems, there is a close relationship between the gold ores and a group of acid rocks, a knowledge of the character and behaviour of the latter would be valuable to the prospector, giving him a rational guide in examining new ground, and a lead to the discovery of new ore-bodies. A preliminary statement is to be published by means of which it is hoped that mining men interested in the subject may be enabled to test the generalization in their own experience.

The coal resources of Rhodesia have also occupied the attention of the Survey. At the request of the Committee of the International Geological Congress, an estimate, giving the resources at 569,411,000 tons, was prepared for their forthcoming report on the coal resources of the world. The estimate is believed to be an exceedingly moderate one, in view of the fact that only those seams were taken into account the quality of which was known from analysis, and the extent of which was known from prospecting operations. In fact, as a result of the survey of the Wankie field mentioned below, the total may be raised by the addition of 400,000,000 tons. The revised total gives 969,411,000 tons, of which 825,852,000 tons, or 85% is steam coal, the remainder including both semi-anthracite and bituminous coals.

The northwestern portion of the Wankie coalfield, including the main basin in which the colliery is situated, has been mapped. This work involved the making of a topographical map of the area, those in existence being too inaccurate for the purpose. The geological work has determined the succession of rocks and the structure of this region. The discovery of fossil plants is interesting, as proving what perhaps was never seriously doubted by geologists, that the Wankie coal beds belong to the lower part of the Karroo system. The main coal seam is known to be a thick one, and the best in the sub-continent for steam-raising purposes. The survey of the district

now shows that the basin in which the colliery is situated, although bounded in part by faults, is simple in structure, and remarkably free from faults and other disturbances. Estimates of the resources of the district made previously to the survey showed a large reserve. Not only is this now confirmed, but a large addition may be made with confidence. It is probable that 600,000,000 tons of coal could be taken out of the district mapped. The geological map and report are in an advanced stage of preparation. Their publication should be of assistance to engineers examining other coalfields in the territory.

CURRENT LITERATURE.

Electric versus Steam Hoists.—The May issue of the *Journal* of the South African Institution of Engineers contains a paper by — Kestner entitled 'Hauling from Great Depths.' His figures showed that hoisting by steam engines was cheaper than electric hoisting. Naturally the Rand engineers had much to say in criticism.

Pit Props.—The *Colliery Guardian* for June 27 describes the Reinhard system of iron props used extensively in Germany for supporting the roof near the working face.

Measurement of Air in Mines.—The *Colliery Guardian* for June 20 contains a report of a lecture by Professor Henry Louis on the methods of measuring ventilating currents in mines, in the course of which he described his own anemometer.

Reinforced Concrete in Mines.—At the June meeting of the South Staffordshire Institute of Mining Engineers, F. M. Dixon read a paper on the application of reinforced concrete structures for use in mining.

Concentration at Nipissing.—In the *Canadian Mining Journal*, Reginald E. Hore describes the picking and jigging plant at the Nipissing silver mine, Cobalt.

Feeding Zinc-Dust.—In the *Mining and Scientific Press* for June 7, Donald F. Irwin describes machines used at El Tigre, Sonora, for feeding and emulsifying zinc-dust.

Uranium in Colorado.—In the *Mining and Scientific Press* for June 7, Forbes Rickard describes the mining of pitchblende at Quartz Hill, Gilpin county, Colorado.

Zaaiplaats Tin Mine.—The *South African Mining Journal* for June 7 describes the latest developments at the Zaaiplaats tin mine in the Northern Transvaal.

Queensland Sapphires.—In the *Queensland Government Mining Journal* for May, Lionel C. Ball describes the Anakie sapphire district of Queensland.

Zinc in Winconsin.—In the *Mining and Engineering World* for June 11 H. B. Pulsifer commences a series of articles on the Winconsin zinc district, where operations were originally commenced in 1860 by the Matthiessen & Hegeler company.

Sun-Power in Egypt.—In our issue of November last we gave a précis of an article on the Shuman sun-power plant erected in Egypt. The sun's rays are concentrated by mirrors and water evaporated. A special form of low-pressure steam turbine is used. In the *Engineer* for May 30, this turbine is described. It is made by Fraser & Chalmers.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

A Treatise on Petroleum. By Sir Boverton Redwood. Third edition, entirely revised and greatly enlarged. London: Charles Griffin & Co. Price 50s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The importance of petroleum has made such rapid advances in so many directions during the last half-dozen years, that every engineer has to be fairly well acquainted with its occurrence, method of winning, and commercial application. For this reason the new edition of Redwood's 'Petroleum' will be universally welcome. A vast amount of new matter has been added, and it has been necessary to bind the book in three volumes. The author acknowledges the co-operation of many specialists, W. H. and L. V. Dalton, A. W. Eastlake, John Wishart, Robert Redwood, Vivian B. Lewes, A. Cooper-Key, William Sutton, S. Lister James, and others. Before describing the contents and scope of the work, we may make the prefatory remark that the maps showing the distribution of oil deposits and the working drawings of plant greatly add to the interest and value of the book.

The first volume commences with a historical account of the petroleum industry. From the earliest times petroleum has been known and used in various ways in eastern Europe and western Asia, and in recent days the deposits on the Caspian sea and in Austria and Roumania were the first to be exploited on a large scale. In Great Britain the Scottish oil-shales became industrially important a hundred years ago. The author devotes 200 pages to the detailed description of the oil deposits throughout the world. The next section is devoted to the physical and chemical properties of petroleum and natural gas. This section contains much new material, noteworthy among which is a table of the specific heats of numerous samples. Then follows a discussion of the theories of origin of petroleum and natural gas; the inorganic origin is dismissed briefly. Section five is devoted to a description of the various methods of drilling and sinking wells.

The second volume commences with a chapter on the refining of petroleum and the preparation of the various marketable products. Then comes a description of the shale-oil industry of Scotland. A useful chapter is devoted to pipe-lines, storage tanks, and the transport of oil in steamers. The next deals with the testing of petroleum and its products, and finally the uses are discussed, including lighting, lubrication, and the production of power.

The third volume is devoted to regulations relating to the use, transport, testing, and storage of petroleum and its products, statistics of production, and import duties in all countries. No fewer than 160 pages of closely-printed type are devoted to an excellent bibliography. The index is full and complete.

Rand Metallurgical Practice, Vol. I. Second edition. By W. A. Caldecott and others. Cloth, octavo, 490 pages, with many illustrations. London: Charles Griffin & Co. Price 21s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

In our issue of April a year ago we extended a welcome to this notable addition to metallurgical literature, and we are not surprised to find that our view has been shared by engineers generally, as is evidenced by the fact that a new edition has already been required. We may also include the publishers when distributing our congratulations on the success of the book, for to them is due no small share of this success.

The contents of the new edition may appear to the casual observer to be practically the same as those of the first, but we can assure our readers that there are multitudes of detailed improvements, additions, and corrections; we have seen the proof sheets, so we know.

For the benefit of those who are not fully aware of the nature and object of this book, we may say that it has been written by a number of experts in Rand practice, headed by W. A. Caldecott. The first chapter is by Ralph Stokes, and contains an outline of the history of the Rand, its geology, and economic problems. Mr. Stokes is a well known author, journalist, and mining engineer. He was one of the underground staff of the Crown Mines, and is now with the Canadian Exploration Company. The second chapter describes the sorting and breaking stations, and is written by J. E. Thomas. The chapter on the cyanidation of sand is by the same writer. G. O. Smart describes the stamp-mill practice, and W. R. Dowling takes as his subject the tube-mill and slime department. H. A. White discusses the principle of slime treatment, E. H. Johnson precipitation, cleaning-up, and smelting, and A. McArthur Johnson assaying and testing. Finally W. A. Caldecott reviews the chemical and metallurgical problems connected with the treatment of blanket ore. We have no doubt the book will continue to be a good seller for a long time; it is certainly a work that will be of permanent importance.

Mines and Mining in the Lake District. Third edition. By John Postlethwaite. Whitehaven: W. H. Moss & Sons. Price 3s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is the third edition of a book originally published in 1877. Many parts relating to the geology have been elaborated, the maps and illustrations have been improved, and recent geological opinions by leading scientists have been incorporated. In its present form, the book constitutes an excellent monograph, on a small scale, relating to a romantic and beautiful corner of the world, and as such it should be found in the libraries of all geologists and mining men, or even on their drawing-room tables. The writer of this review personally owes much to the first edition of Mr. Postlethwaite's description of the rocks and minerals of Lakeland, for it was this that attracted him as a boy to the charm of geological study, and that first edition is still one of his boyhood's treasured relics.

By the inhabitant of northern England the term 'Lake District' is applied to the southern part of Cumberland, north Lancashire, and the western part of Westmorland, a region of circular shape measuring about 30 miles in diameter. In this small space is contained a greater variety of beauty spots in miniature than in any other part of the world; crags and precipices, torrents and waterfalls, scenes of stony desolation, lakes with verdant shores, mountains and rocks that test the skill of the hardest climbers, hill-sides clothed with bracken and heather. Moreover, was it not the home of Wordsworth, Southey, and Ruskin? The geology is of unusual interest, and has been the source of much discussion. The central district is composed of an extensive series of lava flows, volcanic breccias, and beds of coarse and fine volcanic ash, lying conformably one upon the other, upon the slates of the Lower Silurian Age, and dipping at the southern part of the district below more recent rocks of the Upper Silurian and Carboniferous periods. These volcanic rocks are intensely hard, and the ash

beds have the same cleavage as the adjoining slates. In fact they are worked as slate, and they are well known in the stone trade by their characteristic green chloritic colour. There is a strong probability that Cumberland in Lower Silurian times was the centre of great volcanic activity that commenced below the level of the sea. The western and southern fringe consists of Carboniferous rocks, containing valuable coalfields in the Whitehaven district, and the celebrated Cumberland hematite in the limestone. As regards other metals, copper, lead, and zinc ores are found in the slate and volcanic rocks in the neighbourhood of granite and other intrusives at various isolated spots; also at some places where there is no outcropping granite, a fact leading to the conclusion that a batholith of granite lies below the whole district. The copper and lead ores were known before the Roman days. In the fifteenth century Keswick was an important copper-smelting centre. A few mines are still worked, notably the Greenside silver-lead mine on the flanks of Helvellyn, equipped with the most modern dressing plant, and the Thornthwaite opposite Skiddaw. Nor must the graphitic mine of Borrowdale be forgotten. In its day it was the richest in the world, and Keswick pencils were used universally. Mr. Postlethwaite, as a close student of the ore deposits and as a lover of his native county, would like to see some of the old copper and lead mines re-opened. His book gives the information required by those inclined to take the venture.

E. W.

The Magnetic Iron Sands of Natashkwan, Quebec. By George C. Mackenzie. Pamphlet, 58 pages, with many maps and illustrations. Ottawa: Government Printing Bureau.

This pamphlet is one of the series of monographs published by the Canadian Department of Mines, under the general direction of Eugene Haanel. It describes the magnetic iron sands on the sea-shore on the northern side of the Gulf of St. Lawrence, opposite Newfoundland and Anticosti island. These deposits have been known for over 50 years, and in the sixties one was worked and the concentrate smelted. Owing, however, to a hostile tariff specially imposed by the United States, the chief market was lost, and the enterprise failed. The Natashkwan deposits have recently been extensively drilled and sampled, and a Grondal magnetic separator and Grondal briquetting plant are to be erected.

Past and Present Metal Markets. By W. E. Figgis. Melbourne: Critchley Parker; London: Hill Publishing Co. Price 15s. For sale at the Technical Bookshop of *The Mining Magazine*.

Mr. Figgis has prepared two charts and an accompanying pamphlet of 50 pages, recording the prices of copper, tin, lead, zinc, and silver from 1890 to the present time, with spaces left on the charts for the next seven years. One chart is concerned with copper and tin, and the other with lead, zinc, and silver. This classification will be convenient in obtaining a comparative view of the variations in price of the metals of two groups. The pamphlet gives much useful statistical information about these metals.

The Gold Fields of Atlin, B.C. Pamphlet, 36 pages, with map. London: Alexander Moring, Ltd. Price 1s.

This pamphlet has been published by the authority of the Atlin district board of trade. It will serve to draw attention once more to a placer-gold district, which has been neglected of late, situated behind Chilkooot and Juneau City.

COMPANY REPORTS

Poderosa.—This company was formed in 1908 to acquire from local owners a group of copper mines in the Collahuasi district of Chile, not far from the Bolivian border. Robert Hawxhurst, Jr., was the first manager, and he described the properties in our issue of October 1910. He was succeeded by C. H. Macnutt, who served in that capacity for two years. The mines are 15,000 ft. above the sea, in an inhospitable climate, and the conditions are such that no engineer can be asked to stay long. A dividend was paid in 1909, much against the wishes of Mr. Hawxhurst, as no allowance was made for further development. Since then, several adverse circumstances below and above ground and in connection with the climate have prevented a financial recovery until the middle of 1912. The report for 1912 shows that the amount of ore raised was 11,763 tons, averaging 19% copper, together with 21,752 tons, averaging $3\frac{1}{2}$ to 4% copper, reckoned as waste and placed on the dump. Most of this came

remainder, £51,521, was transferred to capital account for expenditure on new plant, etc. The general industrial activity in Brazil has drawn away many of the miners, and it has been necessary to revise the terms and methods of engagement, to introduce labour-saving machines, and to install modern plant that will produce power more economically. Houses are to be built for the better class of workmen, and wages have been raised. By the consent of the Brazilian and Japanese governments, an experimental importation of 100 Japanese labourers has been arranged. Electric hauling is to be adopted in the lower levels, and the compressed-air power thus released will be used for additional rock-drills. Development has been hindered by the scarcity of labour. The deepest working is on the 18th level, 4900-ft. vertically below the adit. Here the level has just cut the lode. George Chalmers, the manager, in his usual comprehensive report, refers again to the question of the reduction of temperature in the lower levels, details of which we have given in previous issues. As no further means of ven-



THE PODEROSA MINE, CHILE.

from the Poderosa mine, with smaller amounts from the Rosario and San Carlos. The amount of ore shipped to Europe, through the port of Mejillones, was 11,318 tons, averaging 22% copper. The net income from the sale of ore was £150,598, and the balance of profit was £54,705. As the year began with an adverse balance of £47,033, the balance now carried forward amounted to £7671. The new manager, C. Crempien, estimates the ore reserve at 15,760 tons, averaging 21% copper.

St. John del Rey.—In our issue of July of last year we recorded that the gold output for the year ended February 29, 1912, was the largest ever produced at the celebrated Morro Velho mine, in Brazil, since the commencement of operations in 1834. Unfortunately the scarcity of labour has made it impossible to maintain the high figures. The report for the year ended February 28 last shows that the amount of ore treated was 172,208 tons, a fall of 20,400 tons, and the production of gold £396,109, a fall of £46,300. The yield per ton remained the same at 46s. The working cost was £253,166, which was lower by £14,046, but the cost per ton was higher on account of the smaller tonnage treated, the figure being 29s. 5d. In addition to this working cost, £17,400 was paid as duty and transport charges, £4553 on development, £5310 on the London office, £4505 as debenture interest, £5028 as income tax. The preference shares received £10,000, the usual 10%; and the ordinary shares received a similar dividend, absorbing £54,626. The

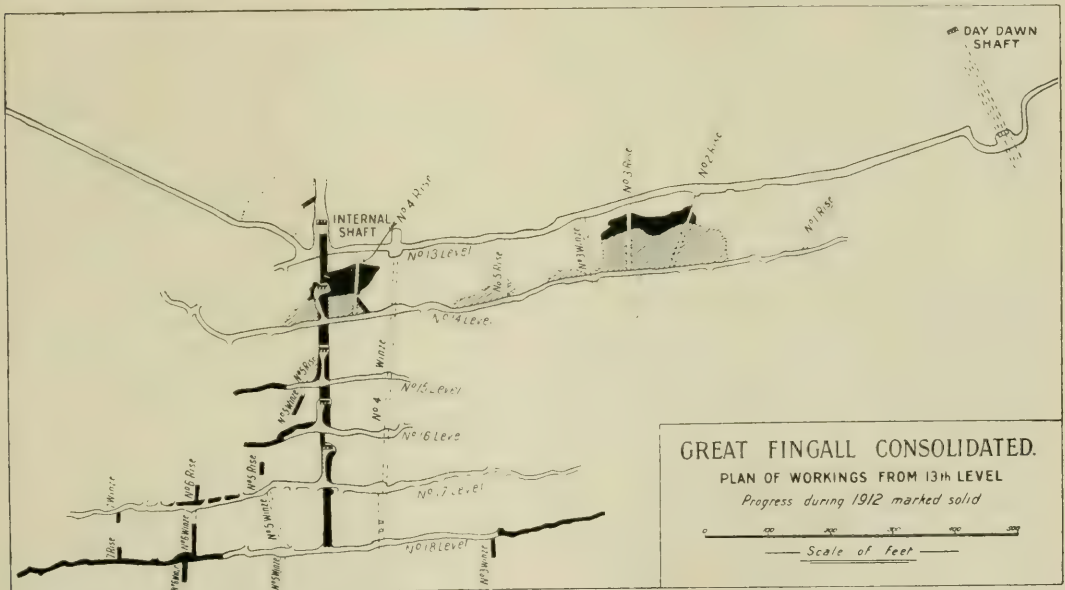
tilation has been provided, it has not been possible to decrease the temperature to any notable extent. He also describes the improvements introduced in the crushing and cyaniding departments.

Zinc Corporation.—As we have recorded many times in previous issues, this company was formed by Bewick, Moreing & Co. in 1905 to treat the zinc tailing at Broken Hill by flotation methods. The early days were occupied largely with trials of the various plants and processes. Eventually the Elmore vacuum process was adopted and profits were made, but afterward in 1910 the improved Minerals Separation plant was installed. In 1911 the South Blocks mine was purchased, the policy being to acquire a mine in the neighbourhood instead of depending on dumps and tailings from other companies. The report for 1912 now published shows that the lead-concentration plant at South Blocks treated 138,284 tons of ore, averaging 15.3% lead, 9.16% zinc, and 2.57 oz. silver per ton, and produced 25,227 tons of concentrate, averaging 67.3% lead, 6.2% zinc, and 9 oz. silver per ton, together with 36,800 tons of zinc tailing, averaging 17.1% zinc, 5.2% lead, and 1.8 oz. silver per ton. The zinc plant treated 345,425 tons, averaging 14.41% zinc, 5.5% lead, and 6.94 oz. silver per ton, and produced 85,354 tons of zinc concentrate, averaging 47.2% zinc, 7.4% lead, and 12.5 oz. silver per ton, together with 10,881 tons of lead concentrate, averaging 57.9% lead, 14.8% zinc, and 32.2 oz. silver per ton. In addition 5971 tons of zinc slime was produced, averaging

38·6% zinc, 14·9% lead, and 25·1 oz. silver per ton. The Lyster process has been adopted for extracting the galena from the slime coming from the lead concentrator, and the Horwood process of differential roasting is to be used for treating the zinc slime coming from the zinc concentrator, with the object of deadening the galena to the influence of flotation by coating it with a film of sulphate. We have already recorded the results of mining at the 8th level of the South Blocks, where the lode has been proved to be 85 ft. wide, and the acquisition of the Sunny Corner property and the formation of the subsidiary company 'Zinc No. 1' to work it. The reserve on December 31 was 1,844,748 tons of purchased tailing, averaging 14·7% zinc, 5% lead, and 6 oz. silver per ton, and 721,191 tons of ore at South Blocks, averaging 14·4% lead, 9·1% zinc, and 2·3 oz. silver per ton, this not including anything found on the 8th level. The accounts for the year show an income from the sale of concentrate of £644,428, and a profit, after allowance for payment for concentrate, depreciation, and all expenses, of £232,831, out of which £206,433 has been paid as dividend.

220,800 tons, averaging 11·9% lead, 13·6% zinc, and 10·4 oz. silver. Much development and prospecting work has been done during the half-year, but without disclosing any notable amount of ore. The lead concentration plant, as re-organized a year ago by George Weir, of the North Broken Hill, is giving greatly improved results.

Great Fingall Consolidated.—This company was formed in 1899 as an amalgamation of the Great Fingall Reefs and the Consolidated Murchison Gold Mines, which owned property at Day Dawn, near Cue, West Australia. Bewick, Moreing & Co. are the managers. From 1901 to 1908 excellent profits were made, and the capital of £125,000 was returned 14 times. A zone of impoverishment was then reached and the prospects of finding profitable ore below the 13th level were not encouraging. Eventually the ground 1100-ft west of the main shaft proved to be profitable, and several levels have been driven there. An auxiliary shaft is now in course of construction, as shown in the accompanying illustration. For the last three years, 40 out of the 100 stamps have been at work, and reduced dividends have been paid. The



Broken Hill Block 10.—The report of this company for the six months ended March 31 shows that 46,119 tons of ore was raised, averaging 11·9% lead, 13·1% zinc, and 10·2 oz. silver. The lead-concentration plant extracted 5961 tons of concentrate, averaging 64·9% lead, 6·5% zinc, and 35·8 oz. silver. The zinc tailing, amounting to 34,055 tons, and averaging 14·1% zinc, 3·2% lead, and 5·3 oz. silver, was delivered to the Amalgamated Zinc (De Bavay's) for treatment, and 7375 tons of slime, averaging 13% lead, 21% zinc, and 15 oz. silver was sold to the Junction North company. In addition, 21,263 tons of zinc tailing from the dump, averaging 20·5% zinc, 6% lead, and 8·2 oz. silver was delivered to the Amalgamated Zinc. The accounts show a revenue of £61,624 from the sale of lead concentrate, and £10,277 from the sale of tailing and slime. The net profit for the half-year was £16,860, and £20,000 was distributed as dividend, being 4s. on each £10 share. O. B. Ward, the manager, estimated the reserve on March 31 at

report for the year 1912 shows that 67,177 tons was raised and treated, yielding 19,333 oz., and 115,934 tons of sand and slime treated for a yield of 7755 oz. Custom ore and accumulated slag accounted for 3925 oz., bringing the total output to 31,013 oz. The income was £133,909, including £16,262 received for gold won from custom ore. The working cost was £93,169, and the price paid for, and cost of tributors' ore, £13,632; in addition, £19,031 was spent on the auxiliary shaft, and £10,647 on development. The general manager's report, from which we quote, includes also expenditure on inspection of new properties in the expenses, and leaves a balance of expenditure over income of £5706 for the year. On the other hand the directors in their report allocate expenditure on the auxiliary shaft to capital account, and thereby release £12,500 to be available for the payment of a dividend of 10%. The ore reserve on December 31 was estimated at 21,151 tons above the 14th level, having an assay-value of 26s. 5d. per ton, and below

the 14th level 50,308 tons, averaging 40s. per ton. Owing to the irregular nature of the ore deposit and of the distribution of the gold, it is probable that stoping operations will include unprofitable rock, so that the average ore raised will be of lower content than the estimate quoted. The completion of the auxiliary shaft has been delayed by scarcity of labour, and in the meantime it is not possible to raise ore from the deeper levels. The ore at present treated comes from the reserve in the older part of the mine. It is hoped that the auxiliary shaft will be ready almost immediately, and that ore can thereby be raised from the deeper levels before the reserve in the upper levels is exhausted.

Mountain Queen.—This company was another offshoot of the Lake View Consols, under the circumstances detailed in the previous paragraph. It was formed in 1910 to acquire a gold-mining property situated 19 miles south of Southern Cross, West Australia. James Brothers are the consulting engineers, Bewick, Moreing & Co. are the general managers, and F. L. Thomas is mine superintendent. A year ago the Transvaal mine, in the same district, was acquired from the same vendors, £45,000 in shares being issued for the purpose. The report now issued covers the year 1912, and shows that at the Mountain Queen mine the oxidized ore is nearing exhaustion. The reserve on December 31 was 26,780 tons, averaging 26s. 4d. per ton, above the No. 2 level. The sulphide zone has not been tested to so great an extent as to warrant exact estimates. The general managers mention 15,000 tons, averaging 27s. 6d., as probable figures. The method of treating the sulphide ore has not been settled; but it is stated that little alteration should be required in the present plant in order to meet the new requirements. During the year, 43,393 tons of ore was raised, yielding 7431 oz. gold by amalgamation and 1811 oz. by cyaniding. In addition, 3149 tons of accumulated slime yielded 347 oz. The total production of gold was 9589 oz., worth £40,684. The accounts show a profit of £169, after all expenses had been paid in connection with development at the Transvaal mine, and allowance made for depreciation. The mill at Mountain Queen consists of 2 Holman air-cushion stamps. The installation and results obtained were described in our issue of November last. These stamps were supplied by the makers on approval, and the report states that "they have proved highly efficient." The 2 stamps between them crushed 74½ tons per 24 hours. As regards the Transvaal mine, the lode has been proved for 1200-ft. on the 60-ft. level, and 740-ft. on the 140-ft. level, and it is stated that the indications are favourable to a continuance of the orebody in depth. The reserve is estimated at 48,500 tons, averaging 44s. per ton. The ore is arsenical, and the metallurgical treatment has not yet been fixed.

Zeehan-Montana.—This company was formed in 1892 as a subsidiary of the Mount Zeehan (Tasmania) Silver Lead Mines Co. D. C. Griffith is chairman. For some years satisfactory profits were made. In 1908 the reserve was exhausted, but the manager, John Craze, continued developments and was rewarded by the discovery of other orebodies, though of inferior grade. In 1910 and 1911 the payment of dividends was resumed. The report for 1912 shows that receipts and expenditure have been about equal, and the small balance of profit has been carried forward. The amount of ore raised was 9560 tons, of which 624 tons was shipping ore, and 8936 tons concentrating ore, averaging 9·4% lead and 10·6 oz. silver. The concentrate recovered was 805 tons. The shipments to Ant-

werp totalled 1200 tons, for which £20,110 was received, after paying freight and returning charges; 239 tons was sold to the Tasmanian Smelting Co., realizing £3618, together with 388 tons of silver-bearing gossan, realizing £304. The profit for the year was £715, which was carried forward.

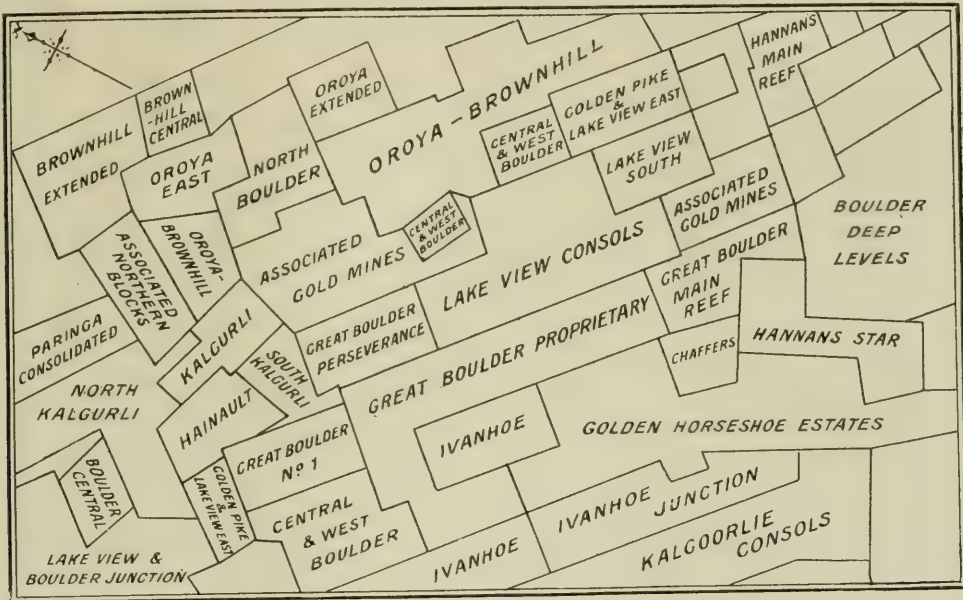
Briseis Tin.—This company was formed in 1899 to acquire a tin-gravel property in the Ringarooma district, northeastern Tasmania. Adjoining properties have since been acquired known as Krushka's Flat and Ringarooma leases, and three years ago the Wallace gold-gravel property in Victoria was acquired. The report for 1912 shows that 92,000 cubic yards at Briseis North yielded 233 tons of black tin, and 169,000 cu. yd. at Krushka's Flat 276·3 tons, the respective yields per cu. yd. being 5·67 and 3·66 lb. In addition, 21·4 tons came from the Ringarooma section and 4·35 tons was recovered at isolated spots, bringing the total yield to 538·86 tons, averaging 74·5% metal. The net income from this source was £84,261, and the average price per ton of tin was £215. 10s. Work at the Ringarooma section has been centred on the stripping of the overburden, of which 243,000 cu. yd. was removed during the year. The original Briseis property is nearly exhausted, and in Krushka's Flat there remains 800,000 cu. yd. estimated to contain 750 tons of black tin. The future of the company depends on the Ringarooma section. So far as the investigations have gone, it is possible to estimate that there are 7½ million cubic yards of material containing 4569 tons of black tin, or rather over 1½ lb. per cu. yd. As regards the Wallace property, four dredges treated 1,547,000 cu. yd. for a yield of gold worth £36,087; after all expenses and royalties were paid, a profit of £13,452 was made. The accounts of the company show a net profit of £43,319, and £45,000 has been distributed as dividend, being at the rate of 7½ p. cent.

Mount Lyell Mining & Railway.—The report of this Tasmanian copper-mining company for the half-year ended March 31 naturally reflects the results of the disastrous fire at the North Lyell that occurred on October 12 last. The fire was extinguished by flooding, and the subsequent unwatering has only just been completed. Before the fire started, 5368 tons of ore was raised from the mine, averaging 6% copper. From the Mount Lyell, 58,586 tons was raised from underground and 7364 tons from the open-cut, and of the total, 56,317 tons was sent to the smelter and 9633 tons to the sulphuric acid and superphosphate works at Melbourne and Adelaide. The necessary fluxing material was obtained from the open-cut at the Lyell Tharsis, as a substitute for North Lyell ore, but the grade was much lower, the 21,242 tons extracted averaging 1·45% copper, ¼ oz. silver, and 0·14 dwt. gold. The Comstock property, adjoining the North Lyell, recently acquired, contains a separate orebody. Little development has been done on this property during the half-year owing to the fire, but arrangements are well forward for extracting 100 tons per day, and up to March 31, 3757 tons had been delivered to the smelter, averaging 3·28% copper, 0·27 oz. silver, and 0·6 dwt. gold. The smelter treated 84,833 tons during the half-year, for a yield of 825 tons of blister copper, containing 813 tons copper, 95,283 oz. silver, and 2260 oz. gold. The copper figure is less than one quarter of the normal, though the total tonnage was maintained. The ore reserve on March 31 was estimated as follows: Mount Lyell, 2,295,232 tons, averaging 0·531% copper, 1·96 oz. silver, and 0·56 dwt. gold; North Lyell, 1,078,384 tons, averaging 6% copper, 1·33 oz. silver, and 0·1 dwt. gold.

The report states that the superphosphate business is flourishing, and that the three works are taxed to their utmost capacity. It is interesting to note that 116 tons of precipitate, containing 56 tons of copper, was recovered from the mine waters of the North Lyell. The accounts show a loss of £27,972 for the half-year, after £11,455 had been allowed for depreciation, and £21,282 for expenses in connection with the fire.

Great Boulder Proprietary.—As we recorded in this column a year ago, the end of this company, owning one of the great gold mines of Kalgoorlie, is within measurable distance, owing to the fact that the main orebody has passed into the property of the Golden Horse-Shoe between the 2650 and 2800-ft. levels, and also become poorer below the 2500-ft. level. The report for 1912 shows that 193,451 long tons of ore was treated, yielding gold worth £573,159, or 59s. per ton.

Lake View & Star.—Three years ago it was decided to segregate the mining and financial interests of the Lake View Consols, of Kalgoorlie, which, on the exhaustion of the rich deposits, gradually developed into a financial and exploration company. The Lake View mine was then handed to a new company, and at the same time the Hannan's Star mine was acquired. The report of this company, the Lake View & Star, for 1912 shows that the Lake View main shaft has been sunk to a depth of 2154-ft. Developments at the 1900-ft. level were on the whole satisfactory, and it is expected that the ore between the 1800 and 1900-ft. levels will all be worth extracting. The ore reserve at Lake View was estimated on December 31 at 107,050 tons, averaging 30s. 4d. per ton. At the Star mine, no new development work was done, as attention was centred on blocking-out the orebodies at



KALGOORLIE.

The profit was £307,744, and the dividends absorbed £262,500, being at the rate of 150% yearly. The production and profits have varied little during the last 10 years. Richard Hamilton, the manager, reports that the ore reserve consists of 652,916 long tons, averaging 14.6 dwt. per ton, as compared with 698,662 tons, averaging 14½ dwt., and under the circumstances the part maintenance of the reserve is highly gratifying. Connection has been made with the workings of the Golden Horse-Shoe at 2050 and 2500 ft., with a consequent improvement in the ventilation. Diamond-drilling has been actively conducted during the year, but the only discovery of note was a lense on the 500-ft. level. The lodes at Kalgoorlie are nearly vertical and the dip varies. It is quite within the bounds of possibility that the lode may return at greater depth to the Proprietary ground, but as the lode below the 2650-ft. level is of poor quality there is little encouragement to sink the shafts deeper. In the meantime drilling at depth is being conducted. As has already been recorded, the option on the Great Victoria mine near Southern Cross was not exercised. The managers continue on the look-out for other suitable properties.

several levels. Here the reserve was estimated at 305,720 tons, averaging 26s. 9d. per ton. During the year 95,258 tons was raised from the Lake View, and 117,348 from the Star, a total of 212,606 tons, which was treated in the 75-stamp mill. The discharge was sent direct to concentrators, and 19,074 tons of concentrate removed. This was roasted, all-slimed, and cyanided, for a yield of 32,715 oz. gold. The tailing was slimed and cyanided separately and yielded 26,396 oz. gold. In addition 25½ tons of slag containing 304 oz. gold was sold. The total production was 59,378 oz., worth £252,890. The net profit was £32,097, out of which £32,000 was distributed as dividend. Bewick, Moreing & Co. are general managers, H. E. Vail mine superintendent, and James Brothers consulting engineers.

Rezende Mines.—This company was formed in 1908, as a third reconstruction of a company originally formed in 1892 to acquire a gold mine in the Umtali district of Rhodesia, near the border of Portuguese territory. We recorded the earlier history of the property in our issue of July 1910, and showed that after 18 years of continued failure, the position had been greatly improved by the acquisition of the control by

the Anglo-French-Farrar group. Subsequently in 1912 the Penhalonga property was absorbed, which had for an equal number of years been as unsuccessful under the control of the Anglo-French-Farrar group. The report for 1912 shows that at the Rezende property 49,380 tons of ore assaying 8 dwt. per ton was sent to the mill, of which an average of 35 stamps were at work, and that the yield was 17,873 oz. gold, being at the rate of $7\frac{1}{2}$ dwt. per ton. The ore reserve is estimated at 101,579 tons averaging 7.38 dwt. per ton, together with 44,020 tons on the hanging wall, of undefined content. At the Penhalonga mine, 68,548 tons of ore was raised, and after the rejection of 34% waste, 45,233 tons was sent to the mill. The ore averaged 4.53 dwt. gold, $2\frac{1}{2}$ oz. silver, and $1\frac{1}{2}$ % lead, and the recovery was 8609 oz. gold, 60,604 oz. silver, and 354 tons of lead, some being in the form of bullion and the rest in concentrate shipped to England. The reserve on December 31 was calculated at 42,827 tons, together with 32,669 tons of probable ore. The income at Rezende was £76,525 and at Penhalonga £49,842. The cost at Rezende was £60,514, and at Penhalonga £40,866. The income from tributors was £5785. The total profit for the year was £30,772, just double of that for 1911. Out of this profit, £6060 has been charged to development reserve account, £1272 to depreciation, £1276 to London expenses, and £444 paid as extra remuneration to directors. The shareholders received £17,764, being at the rate of 15 per cent.

Village Main Reef.—This company was formed in 1888 to acquire claims on the dip of the Salisbury, Jubilee, and City & Suburban mines, on the outcrop on the central Rand, and in 1906 the Wemmer property to the west of the Salisbury was absorbed, after the exhaustion of its rich upper levels. Milling commenced in 1892 with 10 stamps, and in 1898 a new mill of 100 stamps was erected, increased in the following year to 160. When the Wemmer was absorbed, the 60-stamp mill belonging to that company was acquired, so that the present equipment contains 220 stamps. There are also 6 tube-mills. Dividends were first paid in 1898, and from then to the end of 1912, £2,911,943 has been distributed on a nominal capital of £472,000, but it must be remembered that the greater proportion of the £1 shares issued for cash were sold at prices ranging from £3. 10s. to £6. 10s. The mine is now approaching its end, and the reserves are sufficient to last for nearly four years at the present rate of output. Owing to the decreasing number of stope-faces, it will not be possible to maintain the rate of output, and the cost per ton will be consequently increased. The eventual results as regards the extraction of the remaining ore will depend largely on the supply and cost of labour. The company belongs nominally to the Consolidated Gold Fields group, but the technical control is with the Central Mining & Investment Corporation. The report for the year 1912 shows that 563,511 tons was raised, and after the rejection of 16% waste, 470,981 tons was sent to the mill, averaging 9.73 dwt. per ton. The yield by amalgamation was 149,762 oz. and by cyaniding 72,023 oz., making a total of 221,785 oz., worth £929,727, being a recovery of 9.43 dwt., or 39s. 6d. per ton milled. The working cost was £437,512, or 18s. 7d. per ton, leaving a profit of £492,215, or 20s. 11d. per ton. Profits tax, income-tax, and other expenses reduced the profit to £443,175, out of which £165,200 has been distributed as dividend, being at the rate of 35%. The remainder was carried forward, making a balance in hand of £377,239. The existence of the company is being prolonged by the purchase of shares in the

Village Deep. Of these, 17,352 have been bought during the year, bringing the holding to 87,352 shares, out of a total of 1,060,671. The average recent quotation of Village Deep £1 shares has been £2.

Transvaal Gold Mining Estates.—This company belongs to the Central Mining group, and is by far the largest gold-producer owning properties in the Transvaal outside the Witwatersrand series. It was formed in 1895, and owns a number of mines at Pilgrim's Rest, in the Lydenburg district. The Clewer, Duke's Hill South, Theta, Graskop, Peach Tree, and Columbia Hill properties are worked together, in the name of the Central mines, under the management of George Carter; the Elandsdrift is managed by William Patrick; and the Vaalhoek by Andrew Kelly. S. C. B. Aimetti is general manager for the company. During the year ended March 31, 148,834 tons was raised from the Central mines, and sent to the 60 stamps and 3 tube-mills. The yield by amalgamation was 49,070 oz., and by cyanide 47,902 oz., making a total of 96,972 oz., worth £406,753, or 54s. 9d. per ton milled. The working cost was £161,884, or 21s. 9d. per ton milled, leaving a working profit of £245,296, or 33s. per ton. In addition, a profit of £8736 was made from the treatment of 7342 tons of accumulated slime, from which 2572 oz. gold worth £10,724 was extracted. The Clewer mine is now exhausted. The ore reserve at the Central group was estimated on March 31 at 385,547 tons, averaging $14\frac{1}{2}$ dwt. per ton, an increase of 35,828 tons during the year. At the Elandsdrift mine, 7908 tons of ore was mined and treated, yielding 7323 oz. by amalgamation and 1394 oz. by cyanide, making a total of 8717 oz., worth £36,556, or 93s. 8d. per ton milled. The working expenses were £12,329, leaving a profit of £24,259, or 62s. 2d. per ton. The reserve is estimated at 30,210 tons. At the Vaalhoek mine, 15,607 tons was raised and milled, yielding 2473 oz. by amalgamation and 3683 oz. by cyanide, a total of 6156 oz., worth £25,860, or 31s. 7d. per ton. The working cost was £17,465, and the profit £8394, or 10s. 3d. per ton. The ore reserve is estimated at 40,892 oz., averaging 10.3 dwt. Out of the total profits made by the company, £25,170 was paid as tax, £5656 as debenture interest, and £18,436 placed to the debenture redemption fund. The shareholders received £226,584, being at the rate of 37½%. The debenture issue of £124,000 was made three years ago for the purpose of erecting a hydro-electric station, and already £36,872 of this has been redeemed. The dividend for 1912 was the highest recorded.

Hampden Cloncurry Copper Mines.—This company was formed in Melbourne in 1906 by the Baillieu group, for the purpose of acquiring the Hampden and Duchess copper properties, in the Cloncurry district, North Queensland. More recently the Trekelano mine was purchased, and three months ago the McGregor property and the Salmon mine were bought. The company also owns the Mascotte and Scalper properties, and has a working option in the Answer mine. A smelter was built in 1912 and started work in July. In 1909 the company was re-constructed and new capital subscribed, and last year 50,000 new shares of £1 each were placed by Lionel Robinson, Clark & Co. at 50s., chiefly for the purpose of buying the McGregor properties. The option granted to this firm on a further 50,000 shares at 56s. has not been exercised. The report for the six months ended February 28 last shows that 9510 tons, averaging 8½% copper, was raised from the Hampden mine, and 12,121 tons, averaging 17% from the Duchess mine. The smelter treated 24,874 tons, including some from the Salmon and purchased ore, and the matte produced, together

with 2125 tons of accumulated matte, was bessemerized, yielding 3573 tons of blister copper, containing 3538 tons of copper, 1686 oz. gold, and 38,144 oz. silver. The total ore reserve at the various mines was estimated at 268,000 tons, averaging over 10% copper. The Answer and Salmon mines are not included in this estimate. The accounts show an income of £333,173 from the sale of blister copper. After all expenses were paid, and allowance made for depreciation, a profit of £105,521 remained. Out of this, £70,000 was paid as dividend, the first yet recorded, and the remainder carried forward.

Talisman Consolidated.—This company was formed in 1899 to acquire a gold-mining property at Karangahake, New Zealand, about 10 miles west of the

copper as sulphate is done at Clydach, in Swansea valley. Many technical difficulties were experienced in the early years, and the preference dividend was in arrears; but in 1905 the commercial success of the company was assured, and a first dividend was paid on the ordinary shares. Since then there have been several additions to share capital and debentures for the purpose of extending operations. No information is given as to output. The report for the year ended April 30 last shows a net profit of £191,047, after payment of income tax, out of which £26,366 has been distributed on £400,000 7% preference shares, £60,031 on £300,000 ordinary shares, being at the rate of 21½% less tax, and £40,256 on the £50,000 deferred shares. An issue of £125,000 5% debentures was made last



THE TALISMAN MILL.

Waihi. Other properties were absorbed in 1904, and from 1906 onward handsome profits have been made. The report now issued, covering the year ended February 28 last, shows that 42,980 tons of ore was raised and treated, for a yield of 52,589 oz. gold and 223,652 oz. silver, worth £242,190, or £5. 12s. 8d. per ton milled. The amount distributed as dividend was £129,375, being at the rate of 37½%. The ore reserve on February 28 was estimated at 47,653 tons, averaging £6. 2s. 10d. per ton, as compared with 56,791 tons, averaging £6. 3s. 2d. the year before. The decrease in the tonnage is due to the labour troubles, and also to the increased amount of water coming into the workings. Bewick, Moreing & Co. are the general managers, and H. Stansfield is the superintendent.

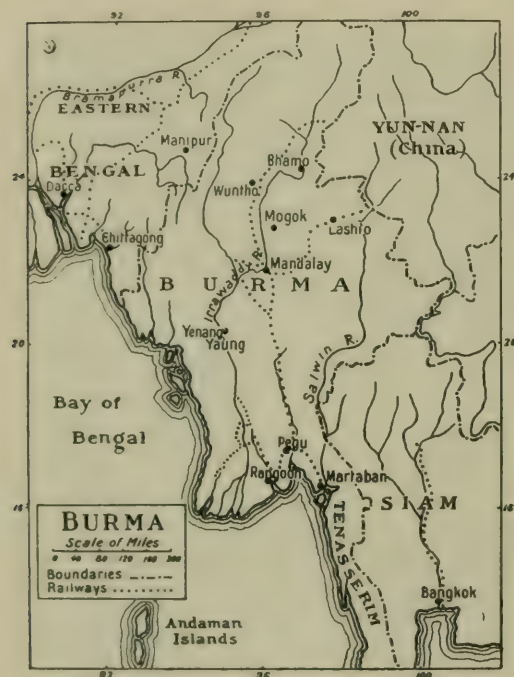
Mond Nickel.—This company was formed in 1900 to acquire the Victoria copper-nickel mines at Sudbury, Ontario, together with the patent rights of Ludwig Mond's process for separating the nickel from the copper matte. The ores are smelted on the spot, and the refining of the nickel and the production of the

November, bringing the total indebtedness to £375,000. This money has been required for the completion of the new smelting works at Coniston, Ontario. Smelting operations commenced in May of this year.

Kramat Pulai.—This company was formed in 1907 to acquire alluvial tin properties at Pulai, in the Kinta district of Perak, a little to the north of Tekka and Gopeng. Nutter & Pearse are the local managers, V. H. Pearson is mine manager, and F. W. Payne & Co. are the consulting engineers. The first dividend was paid in July 1912. The report now published, covering the year 1912, shows that a fourth elevator was added, and three new elevators built to supersede those previously at work. Altogether, 500,400 cu. yd. was treated for a yield of 200 tons of tin concentrate, as compared with 356,228 cu. yd. yielding 198 tons the year before. The concentrate sold for £24,762, and after all charges were met, a profit of £10,546 was left. Out of this, £10,000 has been distributed as dividend, being at the rate of 10%. Up to the present time only the deposits near the surface have been

worked. The consulting engineers are engaged in re-arranging and increasing the pressure of the water-supply, so as to make it possible to work the deeper levels, and to reduce the cost.

Burma Ruby Mines.—This company was floated by the Rothschilds 24 years ago to consolidate the ruby and sapphire gravel-mines at Mogok, Burma. The profits were never as great as expected, for various reasons, the chief being the fall in demand for this class of stone in face of the rivalry of the all-conquering diamond from South Africa. The rent and royalties demanded by the Indian government have also greatly reduced the divisible profits. From 1908 to 1912 no dividend was paid, but in the latter year it



was possible to make a small distribution. The report for the year ended February 28 last shows that the improved position has been maintained. During the year, 1,383,146 loads of ruby earth was washed at a cost of 7.77d. per load, as compared with 1,479,845 loads at 7.5d. per load the year before. The sale of stones out of stock brought an income of £63,896, and £13,346 was received as royalty from leased lands. Against this, £12,006 was paid as royalty, and £2818 as part profit, to the Indian government, and after the payment of all expenses, and due allowance for depreciation, a profit of £5340 was left. Adding to this the balance of £14,546 brought forward from the previous year, the total disposable balance was £19,887, out of which £7475 has been distributed as dividend, being at the rate of 2½%. Two years ago the development was commenced of a new tract of ground in the Kathie valley, 6 miles away. The drainage system here is nearly complete, and washing will commence in a short time. It is interesting to note that the sale of stones in London is limited, the income from this source being only £9783, out of £65,667, the balance coming from local sales.

Tilt Cove Copper.—This company was formed in 1888 to acquire copper mines in Newfoundland, and in 1890 the mines were leased to the Cape Copper company, which pays to the Tilt Cove company half of the annual profits and a rent of £4400. The ore is pyritic with 3 to 4% copper, and is shipped to Britonferry, South Wales, where its sulphur is used in acid and fertilizer manufacture and the residue smelted for copper. The report for 1912 does not give particulars of output, but records a profit at the mines of £15,561, and a net profit of £13,293. Half of this, £6646, was retained by the Cape Copper company, and the other half was received by the Tilt Cove company. After the payment of London management expenses, the balance for the year was £5380. The company has during the year realized its reserve fund invested in Consols, the nominal amount being £10,000. The money thus received was to have been distributed in augmentation of dividends, but the debenture-holders have intervened.

Guiana Gold.—This company was formed in 1905 to acquire from the British Guiana Exploration Syndicate the St. Mary's alluvial gold properties in British Guiana. Dividends have been paid since 1908, totalling 67½% on a capital of £50,000. Four dredges are at work over 20 miles of river. The recovery for the year ended March 31 last was 9162 oz., as compared with 7511 oz. the previous twelve months. The net revenue from the sale of gold was £35,846, and after £4960 had been allowed for the depreciation of plant, a profit of £8828 was made. Out of this, £7500 has been distributed as dividend, being at the rate of 15 per cent.

Sissert.—This company was formed in London in June 1912, to acquire the whole of the share capital (£630,000) of a Russian company of similar name. The property owned by the latter consists of an estate covering 500 square miles, in the Ural mountains, to the south of Ekaterinburg, and not far from Kyshtim. The estate contains copper mines and iron works. Of the mines, the Polesky and Gumeshevsky are old, and there are dumps of ore previously discarded now being treated; while the Sysselsky was only opened in 1906. The report for the year ended May 31 shows that 33,935 tons of ore was raised, averaging 4½% copper, and 22,580 tons treated, yielding 1166 tons of metal. In addition, 88,520 tons was leached, yielding 325 tons. The iron furnaces produced 18,020 tons of pig iron. Of gold, 6467 oz. was produced, and of platinum, 1377 oz. The English company received £45,789 as dividend from the Russian company, and a net balance of £43,715 was left after London expenses were paid. The ore deposits were described in an article by H. W. Turner in our issue of June last year, and A. L. Simon described the leaching plant in a paper read before the Institution of Mining and Metallurgy in December 1909, and reported in our issue of January 1910.

At the meeting of shareholders held on June 26, the chairman announced that the diamond-drilling operations conducted at the Sysselsky and Gumeshevsky mines had not so far given results. The bore-hole at the former had either been deflected from the direction intended or else the orebody is faulted. At the latter, loose ground was encountered, so it will be necessary to start afresh with a larger drill and to use tubing. Drilling is also to be undertaken at the Degtiarsky mine. As regards the new central shaft that was to be sunk at the Sysselsky, this project has been abandoned, and the old shafts are to be deepened. The ore reserve at Sysselsky is sufficient for 2 years, and at Gumeshevsky there is 'clay' ore enough to supply the leaching plant for 6 years.

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Scientia non habet inimicum nisi ignorantem.

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EDGAR RICKARD, Managing Director.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	May 31 Tons	June 30 Tons	July 31 Tons
In England	20,524	19,233	18,037
In France	3,380	2,859	3,132
Afloat from Chile	1,700	1,350	2,175
Afloat from Australia	4,000	4,700	5,000
In Rotterdam	4,800	4,700	4,000
In Hamburg	3,822	3,441	1,584
In Bremen	1,961	1,913	1,699
In other European Ports..	1,500	1,300	1,200
Total European visible supply	41,687	39,496	36,827

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Production.	Deliveries		Stocks at end of month
		Domes- tic	Foreign	Total
Total, 1911.....	639,258	316,791	337,009	653,800
Total, 1912.....	706,052	365,920	333,212	699,132
January	64,053	29,111	26,956	56,067
February	58,460	26,641	32,219	58,860
March	60,822	34,190	34,682	68,872
April	60,416	34,892	38,346	73,238
May	63,088	36,209	30,477	66,686
June	54,402	30,559	30,396	60,955
July	61,640	26,296	35,035	61,331

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
Year 1912	8,753,563	370,731	9,124,299	38,757,560
January 1913	760,981	28,409	789,390	3,353,116
February	702,394	31,728	734,122	3,118,352
March	760,324	30,228	790,552	3,358,050
April	755,858	29,116	784,974	3,334,358
May	761,349	32,957	794,306	3,373,998
June	716,267	30,810	747,077	3,173,382
July	625,107	30,282	655,389	2,783,917

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
July 1912.....	2,149,785	28 6	18 8	9 11	1,061,089
August	2,121,455	28 9	18 10	10 0	1,055,315
September	2,081,295	28 7	18 8	10 0	1,040,820
October	2,200,709	28 0	18 3	9 10	1,079,334
November	2,155,690	28 2	18 5	9 10	1,059,564
December	2,218,305	28 0	18 0	10 3	1,129,372
January 1913.....	2,296,948	27 8	18 0	9 9	1,113,579
February	2,100,137	27 11	18 3	9 9	1,019,774
March	2,321,254	27 5	17 8	9 8	1,121,786
April	2,301,099	27 6	17 11	9 7	1,101,099
May	2,366,726	26 11	17 7	9 4	1,099,397
June	2,177,354	27 6	17 8	9 9	1,061,507

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
July 31, 1912.....	182,925	8,497	15,834	207,256
August 31.....	179,111	8,766	15,934	203,811
September 30.....	180,739	8,783	15,752	205,274
October 31	182,058	8,803	15,496	206,357
November 30	186,881	8,767	14,872	210,520
December 31	191,316	8,634	14,965	214,915
January 31, 1913.....	200,000	8,789	13,912	222,791
February 28.....	207,662	8,877	13,918	230,457
March 31	207,733	9,009	15,041	231,783
April 30	205,424	9,053	15,626	230,103
May 31	197,604	9,062	15,345	222,051
June 30	188,094	9,060	14,654	211,808
July 31	170,242	9,403	13,378	193,023

GOLD OUTPUT OF INDIA.

Year 1911	Year 1912	July 1913	Year 1913
£2,150,050	£2,365,004	£193,859	£1,324,824

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1909	1910	1912	1913
	£	£	£	£
January.....	204,666	227,511	214,918	220,776
February	192,497	203,888	209,744	208,744
March	202,157	228,385	215,102	237,797
April	222,700	228,213	221,476	241,098
May	225,032	224,888	234,407	242,452
June	217,600	214,709	226,867	241,302
July	225,234	195,233	240,514	—
August	228,296	191,423	239,077	—
September	213,249	178,950	230,573	—
October	222,653	234,928	230,072	—
November	236,307	240,573	225,957	—
December	233,397	199,500	218,661	—
Totals.....	2,623,788	2,568,201	2,707,368	1,412,170

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
January	15,903	£66,107	26,098	£107,262	34,857	£144,262
February	15,179	63,081	25,009	102,270	32,544	137,038
March	16,387	67,673	27,228	111,376	36,289	150,060
April	17,237	70,880	27,790	114,796	35,295	146,220
May	24,427	96,409	28,015	115,676	34,507	142,617
June	22,555	92,174	27,784	114,697	30,503	125,764
July	22,510	91,955	30,974	127,800	—	—
August	25,385	103,753	33,015	136,407	—	—
September	26,717	109,039	34,491	142,397	—	—
October	26,826	109,503	34,436	142,414	—	—
November	24,289	99,299	33,183	137,700	—	—
December	24,369	99,569	34,917	144,382	—	—
	261,784	1,069,442	362,940	1,497,179	203,995	845,961

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
Total, 1911	160,021	1,210,447	1,370,468	5,823,522
Total, 1912	83,589	1,199,080	1,282,669	5,449,057
January 1913	9,738	94,967	104,705	444,756
February	8,780	92,207	100,987	428,963
March	754	97,015	97,769	415,294
April	7,920	103,324	111,244	472,532
May	7,094	103,085	110,179	468,007
June	5,112	108,373	113,485	482,050
July	11,705	97,091	108,796	462,133

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	July 1913	1913 to date
	£	£	£	£
Victoria	2,138,000	2,039,400	148,000	1,051,500
Queensland	1,623,390	1,484,160	83,250*	557,150*
New South Wales	769,353	702,129	52,058	350,207
New Zealand	1,808,049	1,345,115	154,319	826,611

* June figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911	615½	£702,599	£114 4 5
Year 1912	6492	£831,908	£128 5 6
January to June, 1913 ..	3127	£419,207	£134 1 2
July 7, 1913	184	£20,386	£110 15 11
July 21	258½	£27,990	£108 7 8
August 5	211½	£23,066	£109 3 10

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1912 tons	July 1913 tons	1913 tons
Metal from Straits to Europe and America	59,036	4,799	35,563
Metallic Content from Bolivia to Europe.....	21,149	2,199	14,802

REVIEW OF MINING

INTRODUCTORY.—The decision of the labour leaders at Johannesburg not to precipitate a general strike has relieved tension on the Rand, and, at the same time, the conclusion of peace at Bucharest has ended the Balkan war. For these mercies we must be thankful. A more cheerful tone prevails on the Stock Exchange, and the City generally feels a lightening of spirit. So far it takes the form of holiday relaxation, but, when the Balkan situation has been further clarified and the labour troubles in South Africa have receded from the immediate foreground, we may expect to see an extension of financial activity. The rise in copper has helped to restore good humour. Our New York correspondent deals with the subject. Sundry items of mining expansion will be found in our review of progress. On the whole the position is enormously better than it was a month ago.

TRANSVAAL.—The decreases in production, during July, amounting to 91,688 oz. gold, and in native labour, aggregating 17,852 workers, are not surprising. They are both the inevitable consequence of recent events. Worse results might have ensued. The Government has the situation well under control, and excellent civic spirit is being exhibited by political and industrial leaders in South Africa. Some readjustments may ensue. It is hoped that they may not prove too drastic. Any increase in wages or shortening of working hours will be keenly felt by the industry. Fully 20% of the tonnage milled on the Rand yields an average profit of less than 2s. 6d. per ton. In these poorer mines the wages amount to £410,000 monthly, as against a working profit of £50,500, of which only 65% is actual profit.

The comparative worthlessness of the official monthly statistics of Rand profits is well illustrated by the June statistics, which show

a normal cost and profit. A decrease of 189,372 tons in the amount of ore treated is the only reminder of the labour troubles. Several mines suffered from the strike, not only in output but in increased expenditure, for the interruption to regular work was felt in the middle of the month and became more serious in the last week.

The sale of 15 City Deep claims to the City & Suburban is alleged to be the final consequence of a technical error in placing the City Deep's working shafts so far on the dip as to leave too much ground for back-stoping and ventilation. Thus an original blunder has entailed the transfer of 600,000 tons of ore to a neighbour company. The suspension of operations in the Hercules and Angelo Deep sections of the East Rand is stated to be due to a large shrinkage in the native labour force, but the unsatisfactory developments in the sections mentioned may be a contributory cause.

Development work in the Brakpan during the second quarter of the current year has been disappointing, the average being 35 inches of 5'7 dwt. ore. This is due to a zone of faulting, beyond which it is expected that normal conditions and richer ore will be disclosed.

The first furnace has been started at the Messina copper mine, and another is to be made ready forthwith.

RHODESIA.—The production of gold in June was 56,991 ounces, worth £242,452. A small decrease, due to the shorter month, is apparent. Among individual mines, the Wanderer is the only one showing a noteworthy decrease.

The Bwana M'Kubwa is more difficult than ever to pronounce. An examination made by Mr. S. J. Speak has justified him in discrediting the assumed amount of ore in reserve. From 120,000 tons, averaging 14% copper, he brings it down to 50,000 tons, averaging 12%, but he ap-

appears to confirm the estimated tonnage of low-grade ore (700,000 tons averaging 5%). However, the economic value of that resource depends on the discovery of sulphide mineral sufficient to make a pyritic-smelting mixture with the oxidized material. One matter of technical interest is the statement by Mr. Speak that the official estimates of tonnage have been falsified by an incorrect unit, namely, the average weight of a cubic foot of ore. For this blunder there is the excuse that the appearance of the ore strangely belies its specific gravity.

A year ago we commented on the affairs of the Eldorado Banket. That warning has been justified by subsequent events. The reserve of ore has been cut in half, owing to poor development and loss of stoping ground through caving. Discrepancies between estimates and extractions continue to undermine confidence in the statements of the management. At the annual meeting Mr. Robert G. Fricker, the chairman, made the best of a poor showing. The parallel reef, as it is called, is no good on the lowest levels, and the main lode exhibits impoverishment. This is only what was reasonably to have been expected, and it should have been recognized at the time when the Eldorado was being boomed on the basis of indefinite persistence of rich orebodies.

Major Frank Johnson's account of the Falcon discrepancy calls for an explanation from Messrs. Ackermann and Pickering. A small number of samples may suffice to discredit an elaborate assay-plan, but when the assayer who tested the smaller number of samples is compelled to acknowledge an error of 24%, it is manifest that the alleged discrepancy assumes an entirely different aspect. Knowing Messrs. Ackermann and Pickering as engineers of the highest repute, we expect that they can explain this curious episode.

WEST AFRICA.—The yield of gold in June was 30,503 ounces, worth £125,764. This is a decrease of 4000 ounces, and is the lowest

output in twelve months. The Abbontiakoon diminished its yield by £3341, the Broomassie by £3638, and the Taquah by £7096. The Prestea and Bibiani made small gains, as did also the two dredging companies on the Ancobra and Offin rivers.

The Abbontiakoon mill has now been crushing ore for a year, but the results are neither decisive nor satisfactory. Ore richer than the average of the mine has been milled. The engineers in charge deserve credit for reducing the working cost and improving the metallurgical extraction. For the first half of the current year the yield has been 41s. 7d. and the working cost 28s. 9d. per ton. Mr. Henry Hay expects to reduce the 'working cost' to 25s., but it is not stated how much the real cost will be, to be deducted from the gross yield before the dividend return is made.

The Prestea has worked another year and ends all square, having allocated what profit there was to depreciation. We should like to see this mine do better for the sake of the technical men in charge, to whom a series of difficulties have been presented, not the least being the optimistic forecasts of their predecessors. With a working cost of 25s. 5d. and an average assay-value of 44s. per ton, it looks, to the untechnical person, as if a pleasant margin of profit was assured. But the actual recovery is only 34s. 5d., and the actual cost of winning the gold is 26s. 5d., for interest must be added.

The flooding of the Abosso below the 11th level was due to heavy rains. It interfered with exploratory work on the 13th level and with stoping below the 11th. However, the pumping plant proved adequate, and the interruption is unimportant.

Mr. J. M. Iles sends a good cablegram from the Rayfield, indicating that the prospecting operations on the Top property have yielded excellent results, and that "a big increase" in output may be expected for September.

AUSTRALASIA.—There is talk of diamond discoveries in an unknown part of Australia.

The Bullfinch is out of debt, and a dividend is on the cards. We hear that Ivanhoe shares are being bought from Adelaide, suggesting that the geological report is deemed encouraging. The strike at Cloncurry is over. Work has been re-started at the Hampden and Elliott mines.

The lode on the 14th level should be cut in the North Broken Hill mine within a few weeks. This will be a big event, for it should ensure 1,300,000 tons more of ore. The present reserve is 2,268,000 tons.

The North and South companies are erecting selective flotation plants for the treatment of slime. This is the beginning of large-scale treatment of accumulated slime, a by-product of which there is 300,000 tons on the South mine, besides the 10 or 12% of the current output that is being slimed, equivalent to 850 tons weekly. The North has only 95,000 tons of accumulated slime, but its current output of that product is 700 to 800 tons per week. This will prove an important source of revenue.

The Consolidated Gold Fields of New Zealand, owning the Wealth of Nations, and its subsidiaries, the Progress and Blackwater companies, are doing much better. The strike disfigured last year's record, but the immediate outlook is excellent. In the Progress a new and important orebody has been found, and diamond-drilling on the 10th level is expected to yield encouraging results. In the Blackwater the 4th, or lowest, level, is making a better showing than any of the upper levels, so that a resumption of dividends is likely.

The Mount Morgan continues to engage attention, for has it not paid £8,129,166 in dividends, and is it not still the largest individual mining enterprise in Australia? The breakdown of the power-plant and the blast-furnaces last year entailed serious loss and derangement of plans, but the repairs and rebuilding since then have been taken in hand so vigorously, to the tune of £250,000, that the entire equipment is expected to be ready

in March next. A complete re-organization is being effected by the new manager, Mr. B. Magnus. We hear that things were at loose ends at the Mount, and that a firm hand was badly needed. The profit for the 12 months ending May 31 was £401,130, out of which £200,000 is distributed in dividends. The ore reserve remains unchanged at 1,433,000 tons of basic ore, averaging 3.5% copper and 10 dwt. gold, and 1,997,000 tons of concentrating ore, containing 2.5% copper and 5 dwt. gold per ton, besides the 750,000 tons of low-grade fluxing ore in the Many Peaks mine. The new plant is designed to treat monthly 27,000 tons of Mt. Morgan and Many Peaks ore combined by direct smelting, besides 15,000 tons of Mt. Morgan ore by concentration, for a production of 1000 tons copper and 12,500 oz. gold monthly.

Better news comes from the Waihi. While the Martha lode continues unprofitable on the 10th level, the Empire and Dreadnought lodes are giving promising assays.

UNITED STATES.—The re-opening of the Plymouth mine, in Amador county, California, is proving successful. This work is being done under the direction of Mr. Albert Burch, for Bewick, Moreing & Co. After unwatering the mine, a winze has been sunk 250 ft. below the 1600-ft. level, and drifts extended each way. The general result is the disclosure of an orebody ranging from 5 to 20 ft. in width and averaging 7 dwt. gold per ton. This ore has been proved for about 250 ft. southward. The extension of the old 1600-ft. level confirms this discovery by finding similar ore overhead; and this again gains in importance from evidence obtained on the 14th and 15th levels. The option expires next April.

Judgment has been given in the case of Minerals Separation v. James M. Hyde for infringement of the former's flotation patents at the Butte & Superior mine. It is held that the Minerals Separation patents cannot be attacked on the point of novelty by quoting

the Everson and Froment patents as alleged anticipations, and that consequently there was infringement on the part of Mr. Hyde. Further details will be given when the full judgment is received on this side.

CANADA.—The Canadian Klondyke Mining Co., of which the Granville Mining Co. owns about one half, started this season with one large dredge. During the season it has had the services of one old dredge and the two additional large dredges erected last year. Mr. J. W. Boyle estimates a profit of \$1,000,000 for the current year. A company has been formed by Mr. A. N. C. Treadgold and his friends, with a view to providing £150,000 working capital for dredging a large consolidation in the Indian river valley, including a number of claims belonging to the Granville company. Mr. Boyle is now testing a similar consolidation of alluvial ground on the Forty-mile river, on behalf of a syndicate allied with the Granville. The shares of that company, by the way, are mainly controlled by a small group, the public interest being confined almost entirely to the debentures.

MEXICO.—We publish a letter from Mexico City. To our correspondent the position seems to have improved. To us it looks precarious. The refusal of the United States to recognize the Huerta government and the resignation of Mr. Lane Wilson, the American ambassador friendly to General Huerta, are not propitious signs. General Felix Diaz is reported to be on his way to Japan, to transmit thanks for Japanese participation in an exhibition, but it is alleged that his real purpose is to arrange for joint action against the United States when occasion arises. Northern Mexico is still in a condition of acute disorder. The Government loan was largely a fizzle, the underwriters being saddled with it. If Huerta does not obtain funds, his ability to pacify the country will be reduced to a minimum. However, if he should win at the forthcoming election, then, being constitutional

president, the United States will recognize his government and all may be well. If not, then chaos.

Among the incidents arising from Mexican brigandage, we note the imprisonment, at Chihuahua, of Mr. Bernard MacDonald. His captors—the Federal party—have released him, and we hope that no great harm was done. Mr. MacDonald was formerly manager of the War Eagle-Centre Star mines, in British Columbia, the Dufferin in Nova Scotia, and the Guanajuato Consolidated at Guanajuato.

The appointment of Mr. André Griffiths as manager of the Dos Estrellas mine, at El Oro, is interesting, but it does not involve any change of control, which remains with the Credit Lyonnais, as represented by Mr. F. J. Fournier.

The drop in Camp Bird and Santa Gertrudis shares is justified by the belated estimate of ore reserves in the Mexican mine. From 1,137,000 tons yielding a profit of \$7,475,000 in June, 1912, the estimate has decreased to 1,047,000 tons, expected to yield a profit of \$4,780,000. The fear that the lowest level was disappointing has been confirmed. Having regard to the facts, the shareholders have the right to complain that they have not been kept properly informed.

Among the British-owned mines to suffer from the Mexican disorders is the Buena Tierra, in Chihuahua. That part of the country has been the particular victim of the warring factions. For a month no news was received from the Buena Tierra. It appears now that the mines in the Santa Eulalia district and the smelter at Chihuahua were closed-down on June 27, work being suspended until August 5. But the smelter remains idle.

CENTRAL AMERICA.—In our editorial columns we refer at some length to the coming flotation of the Bonanza gold mine in Nicaragua, by the Camp Bird company. We may here remind our readers that this and

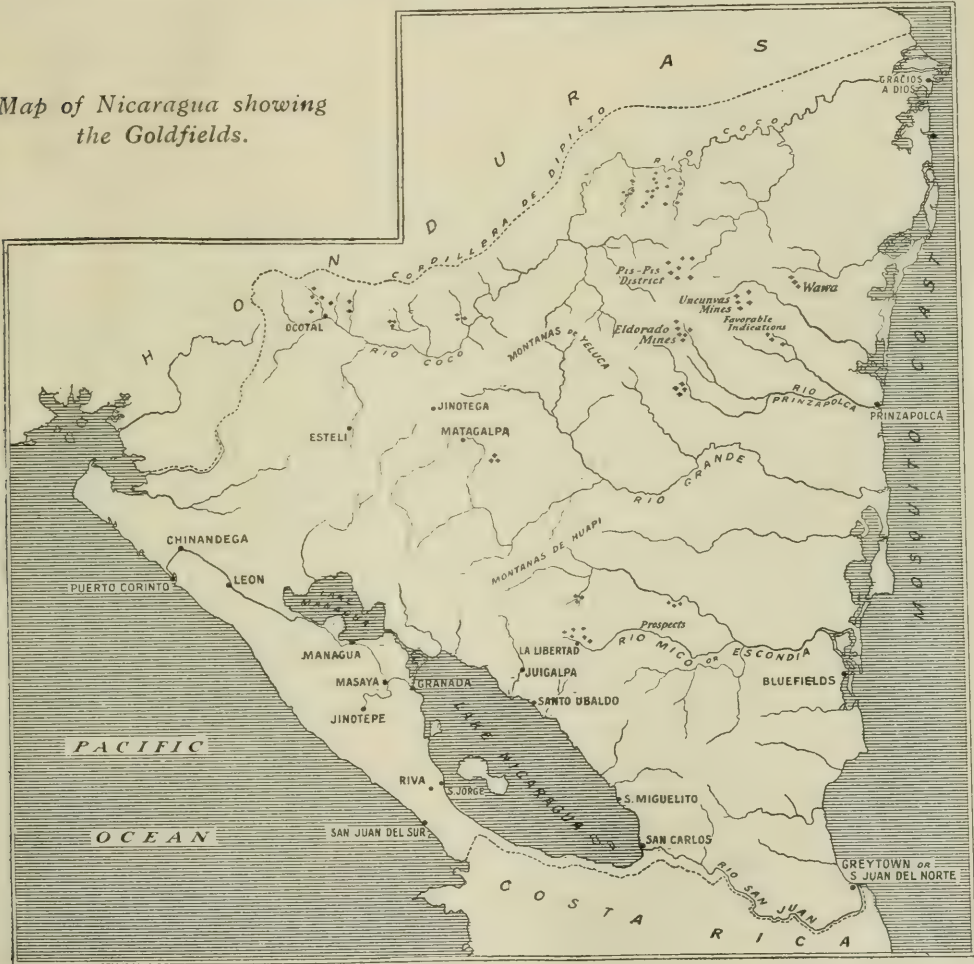
other properties in the Pis Pis district were described by the late T. Lane Carter in our issue of August 1910. We reproduce on this page a map of Nicaragua showing the position of the various goldfields.

INDIA.—The news from the Champion Reef mine shows that developments in Glen's

contains 2 oz. per ton over widths varying from 1 to 3 ft. In Bullen's section the 43rd level is in ore more than 7 ft. wide assaying over 1 oz. per ton.

The exploration of the deep level ground south of the Mysore boundary is being actively pushed. The work is being done by the My-

Map of Nicaragua showing the Goldfields.



section are disclosing ore of high grade at several levels. The lode is 2 ft. wide on the 40th, 41st, and 42nd levels, and the assay-values are 23 dwt., 40 dwt., and 47 dwt. per ton respectively. In the 45th level of Carmichael's section, ore averaging 50 dwt. over 18 inches is being developed. The reports from the Ooregum are also encouraging, for at several points on the 44th level the lode

sore Southern Extension Syndicate, from the workings of the Mysore mine. An important ore-shoot was discovered on the 2385-ft. level, and at the end of the drift the lode is $3\frac{1}{2}$ ft. wide assaying 12 dwt. per ton. It was then decided to proceed to investigate this ore-shoot from the 2160 ft. level, and it has already been found, though insufficient work has been done to estimate its width and content.

RUSSIA.—The Kyshtim continues to prosper at an accelerating rate. During the past year the increase in the reserve of ore is equal to the year's output, namely, 316,000 tons. Additional smelter equipment has been furnished, with a view to treating fine ore. During the current year the production of copper is estimated at 8000 tons; in 1914, 9500 tons; and in 1915, about 10,000 tons. Excellent progress is recorded in all three departments of this company's business, namely, copper, timber, and iron. An option on the Miass estate is suggestive of further expansion.

The Troitzk and Orsk had melancholy meetings. Both exhibit delusive 'operating costs' ending in a debit account. The chairman of the Troitzk company announced that for the first half of the current year the operating profit was £7500. What does that convey? Last year the operating profit was £7800, but the real loss was £600. At the Orsk meeting it was announced that the directors were drawing no fees; the shareholders get no dividends; but British capital is irrigating the shores of the Okhotsk Sea.

The development of the Tanalyk Corporation's mines has progressed so well that it has been decided to raise further working capital, in order not only to complete the smelting plant as designed, but to double the size of it, namely, to a capacity of 7500 tons of ore monthly. The experimental smelter, able to treat 550 tons monthly, was started on July 18, and is proving that the plant as designed is suited to the ore. An issue of £200,000 in 6% convertible debentures is to be made, and at the same time the capital of the company is to be increased from £300,000 to £450,000 by the creation of 150,000 more shares.

VARIOUS. — It is reported at Antwerp that an important gold discovery has been made in the southern part of the Congo Free State.

An epoch in the history of the Tronoh is closed with the resignation of the manager,

Mr. Harry D. Griffiths. He has been in charge for five years. From a poorly developed mine with a bank overdraft he has seen it grow into a famous tin property that has paid 237% in dividends. The richest part (about 20 acres) of the deposit has now been exhausted, but in the 3000 acres owned by the company there remain ample resources of profitable material from which, by improved methods, a handsome profit can be won. Parts of the property can be worked by bucket-dredges, others by open-cut and drifting. Dividends are likely to be less, but a steady profit is assured. We understand that the new manager, Mr. J. H. Rich, is well considered.

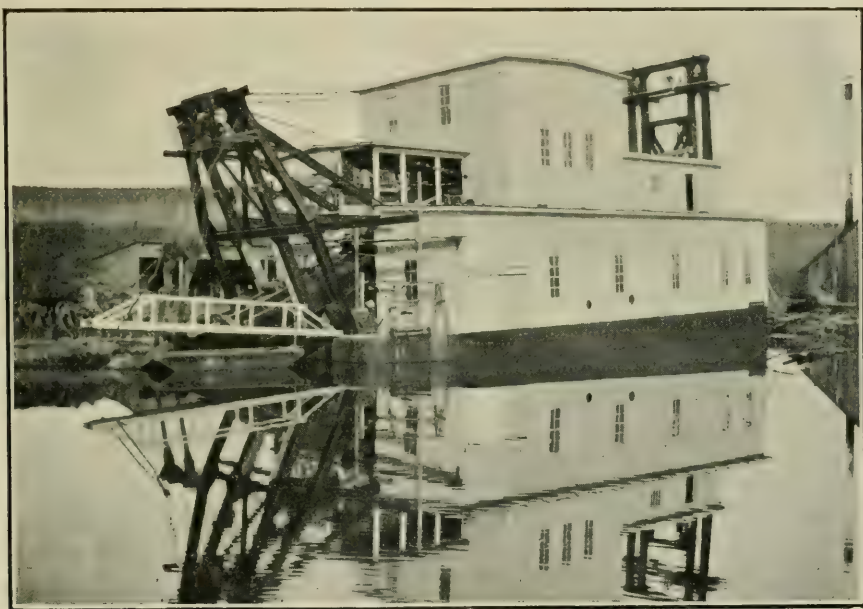
Among tin enterprises in the Far East, that of the Siamese Syndicate makes a healthy showing. A net profit of £40,000 is announced, allowing the payment of three 10% dividends for the year. The mine is in the Renong district, otherwise prominent for the good work done by a company of that name. A dredge started work early last year for the Siamese Syndicate, and two more dredges are being built. The consulting engineers are Cutten Brothers.

One of the largest orebodies to be uncovered during the last decade has been disclosed by the operations of the Burma Mines in the Northern Shan States, within 30 miles of the Chinese border. As is generally known, this company began by smelting the old slag-heaps, building a railway 52 miles long, joining with the Burma railway system. While treating the slag, the work of exploring the old workings was taken in hand, resulting in the exposure of extensive ancient diggings and the evidence of lavish mineralization. Old surface workings and new prospecting underground indicate that ore extends for 2000 to 2500 feet, of which the maximum length so far proved in any one part of the mine is 600 feet; this averages 70 ft. wide of ore assaying 23% lead, 25 oz. silver, 26% zinc, and traces of copper. Another lode carries up to 8% copper, with 10

oz. silver, 9% zinc, and 10% lead. The ore is an extremely intimate and refractory mixture, calling for metallurgical skill similar to that applied at Broken Hill. The largest shareholder is Mr. R. Tilden Smith. Other large holders are the Lake View & Oroya Exploration Co. and Mr. H. C. Hoover. The technical work is in the hands of Bewick, Moreing & Co., as general managers.

The South American Copper Syndicate,

inches, will be available. In the old days heap-roasting was practised, and 12% of coke was required; in the new plant the raw sulphide ore will be smelted by the semi-pyritic process, effecting an economy of at least one-half the coke. Besides the technical change, the old and new operations furnish an instructive financial contrast. The Quebrada Railway, Land & Copper Co., with its cumbersome name, had a burdensome capital: £1,200,000,



DREDGE ON THE KOLCHAN PLACER WORKED BY THE ORSK GOLDFIELDS.

which is operating the old Quebrada mines in the Aroa district of Venezuela, is doing well. Mr. W. J. C. Scrutton is manager, with Messrs. R. E. B. Vinnicombe and G. M. Rudyerd as his assistants. Mr. W. A. Heywood is consulting metallurgist; he was smelter manager to the Quebrada company from 1891 to 1894, so that he is well acquainted with the varied phases of this copper enterprise. The smelter now being erected is to be finished in October. The water-power plant, blowers, and chimney erected by the defunct company will be used, but, instead of the six small circular water-jacketted furnaces, a large modern blast-furnace, 42 by 140

besides £250,000 in 6% debentures. In 1895 the company went into liquidation through a complication of causes, the chief of which were the caving of the incline-shaft, the lack of cash to repair this damage, and the low price of copper. The South American Copper Syndicate is capitalized for £15,000, of which one-half was issued at par, and the other half after the enterprise had proved successful, so that the premium obtained on 7500 shares yielded £80,000, or more than enough for equipment and development. Besides paying £37,500 in dividends, the Syndicate has voted handsome bonuses to the technical staff. This is wise, as well as kind.

EDITORIAL

TRANSVAAL statistics for July are better than expected. The resumption of recruiting should improve the position during August. Further strike and riot are unlikely now that the Government of General Botha has won public support.

RESPONSIBILITY of directors is enforced in a recent decision of an appellate court in New York, whereby a holder of preferred shares was given a verdict for the full amount — \$50,000 — of his investment against a director who lent a reputable name to a disreputable company.

NOT LONG AGO we heard of a man who said that it was extremely useful to belong to the Club, for it made him a member of the "Mining and Metallurgical"; whether it was the Club or the Institution he did not have to say. Confusion may be caused by the similarity of name, and some of it may be intentional. The Club and the Institution have nothing in common except as to chops and cheese. Why not change the name of the Club to the Mining Club? That would put an end to misunderstanding.

WE LEARN that a crusade against the hyphen is being waged in the American press. The *Evening Post* announces that it will no longer write to-day, to-night, or to-morrow, but today, tonight, and tomorrow. It is estimated that 200,000,000 persons write these three words three times daily, on average, and that the elimination of the hyphen will save an amount of energy in the aggregate equal to that required to propel an ordinary passenger train round the world. This is an example, with a vengeance, of the cumulative effect of the infinitely little. For our-

selves, it is interesting in so far as it brings the typographic customs of our contemporaries in accord with our established practice. The hyphen in to-day and to-night has long been atrophied; it fulfils no function; the preposition and the noun are now not betrothed but married, forming a verbal unit. The function of the hyphen is to link words when they express a combination of ideas; that function ceases when the combination has become so fused as to express a unit idea.

WITHDRAWAL of troops from Johannesburg and the resumption of native-labour recruiting marks the end of an episode that has shaken the nerves of all concerned. A salutary lesson has been taught to the Union Government, the employers, and the employed. Agitators and reactionaries alike have been discredited. Sober sense and mutual consideration are recognized as essential to the patient settlement of a difficult problem.

PHENOMENAL is no word for the mining engineer. A thing is a phenomenon when it is outside the range of experience. When an ore deposit has characteristics that are 'phenomenal,' the less said by the engineer the better. We note that Mr. E. C. Borghese cables from the Abu tin mine that "the values are of a phenomenal richness." How can 'values' be of any sort of richness? We advise the shareholders to pay more attention to Mr. Borghese's next statement: "Prospects are most encouraging." That sounds like sense.

IN this issue we publish the second of Mr. Gelasio Caetani's articles on milling. These were recently delivered as lectures at Harvard University. Both the students who listened

to them and the readers who peruse them at their leisure must have been grateful for the clear and forceful exposition of a subject the treatment of which usually lacks satisfactory presentation. It has been a keen pleasure to us to publish Mr. Caetani's writings, knowing how scholarly is the mind and how thorough is the practical training that he is enabled to bring to bear upon this work.

MEXICAN AFFAIRS are coming to a head. The United States refuses to recognize Huerta as President, and he, in turn, declines to receive Mr. Lind, the personal representative of the President of the United States. The American Government is genuinely averse from military intervention, but it seems to be the inevitable sequel to the collapse of diplomacy. Meanwhile, Huerta's position is being undermined, and he may decide to risk a quarrel with the United States in order to consolidate native sentiment. That would mean war.

GENERAL REGRET is expressed at the decision of our Board of Trade not to participate in the Panama Exhibition at San Francisco. Even if the exhibit should be unproductive from a business standpoint, it would be worth several times the cost, as an expression of interest and good-will in the celebration of an event of world-wide importance. The Canal will serve to establish new means of communication between Great Britain and the Pacific coast of North America. It will exert a profound influence on the life and commerce of a part of the world rich in romance and reality; it will knit closer together those ties of kinship to which most of us cling despite all untoward happenings. The official decision, as first formed, is based, we believe, on purely business considerations arising from the unsatisfactory results expected to accrue from an exhibit and disconnected entirely from the unfortunate ques-

tion of Canal tolls. If sentiment is allowed to prevail, it will be only of an amicable kind.

SUCH unofficial and independent estimates of mine-production as we published in our last issue over the signature of Mr. G. A. Troye are sure to be challenged and criticized. We gave them in good faith, and believe them to be extremely valuable to the minority shareholder. At the same time, we think it proper to draw attention to an anomaly. The managements of mining companies on the Rand are compelled to submit calculations of the 'life' of their properties to the Mining Department as a basis for taxation. Such estimates must be justified before the officials to whom they are presented. Moreover, modifications of the estimate can be made by the company if evidence subsequently warrants a revision, as also such fresh evidence can be demanded by the Department in case an extension of productive activity becomes apparent. Naturally the managements do not give life-estimates to their shareholders because any optimistic calculation would entail an increase of taxation; on the other hand, the estimate given to the Department might seem inconsistent with the forecasts of jobbers and other agencies interested in the disposal of shares. Obviously, only too obviously, these estimates of life are just what the shareholders would like to have and ought to be given. It is the information that would most conduce to the stability of the shares, once it had been discounted. Now that shares are so low as to represent a good basis for sensible speculation, it would be well if the public were granted this measure of enlightenment.

WE HAVE REFERRED repeatedly to the uselessness, for the purpose of real information, of stating the gross yield or even the working profit derived from a mine, without an estimate of the general administrative expenses. This applies especially to cases

where those general expenses bear unduly upon the final result of the operations. A striking example is afforded by the Orsk Goldfields, a company the management of which we have criticized more than once for the failure to be explicit beyond the probability of misunderstanding. Thus in the year 1912 this company won gold valued at £36,662 as against an operating cost of £10,509. The gross yield, and sometimes the yardage also, has been published monthly, but it is evident now how misleading such figures can be. The gross output, less the working cost, leaves a theatrical profit of £26,154, but the maintenance of plant during winter required an expenditure of £3044, administration cost £10,583, and royalty exacted £5921, together making £19,549. These expenses are nearly twice the so-called working cost, but they are as essentially a part of the outlay to be incurred in mining in Eastern Siberia as the cost of dredging or washing the gravel. Moreover, the further deductions, equally inevitable, for depreciation, interest on loan, and London expenses, amount to £9748 more. Thus the phantasmal operating profit of £26,154 becomes finally a loss of £3144. This is the figure that conveys the real information. Having regard to the figures published monthly the final result is ridiculous and pathetic.

Rand Labour Troubles.

July proved a troublesome month at Johannesburg. Not until the last day was the tension relaxed. At a midnight session of the Trades Federation it was decided to postpone the declaration of a general strike, pending further effort to remedy alleged grievances. This decision, welcome to the community, undoubtedly was influenced by the obvious trend of public opinion against the agitators who had tried their best to foment a general disruption of industry in South Africa. Meanwhile, a commission of inquiry is engaged in collecting evidence concerning the riots, and

the Government is to appoint a commission representing both sides with a chairman independent of all parties to the dispute. To this commission will be referred the questions of an 8-hour day, a minimum wage, Sunday labour, and wages boards. The Union Government has acted firmly and wisely, not only in bringing a spirit of reason into the bitter quarrel, but in preparing to maintain order in case of a further revolutionary outbreak. For that is what the last affair proves to have been, as we suggested last month; it was not so much the act of striking miners as that of the international riff-raff issuing from the disreputable quarters of Johannesburg.

The outlook is better than at one time it looked. But the position is still delicate. We have no doubt that if the better kind of workers and the more humane of employers would get together, a fair adjustment of difficulties could be made without much delay, but on the one hand are the paid agitators, and on the other are the small men of brief authority who are never happy unless they are domineering the persons who happen to have to take orders from them. These two minorities suffice to embroil the whole mass of reasonable beings. In a broad way we recommend the managers to face the fact that labour-unions are entitled to recognition, and that it remains to make the best of collective bargaining, aided by voluntary boards of conciliation. On the other hand, the men had better realize the stupidity of cutting off their noses to spite their faces, for employment such as theirs, essentially supervisory, is not easy to obtain elsewhere, and the paralysis of the Rand mining industry would do at least as much hurt to them as to the owners of the mines. These latter are mostly non-resident and so would escape the brutalities consequent upon a protracted strike. The Government is standing between the employers and the employed, in a sincere and patriotic effort to prevent further trouble. It is not a matter of politics,

but good citizenship. Of course, if the questions at issue are to be made the touchstone of party politics, then the former political divisions will be obliterated and the mining groups will be thrown into the arms of the old Boer leaders. Such a development may tend to heal lingering radical discords, but it will introduce an alignment based upon purely industrial factors. That would be no gain to South Africa. Leaving such aspects of the problem, we turn to another, equally suggestive. During the discussion arising from the recent riot at Johannesburg, we have seen references to the unhealthy character of the work underground. The miner on the Rand has been pictured as the victim of the lust for gold. Within limits, this is true; for no man who works underground 15 years is immune from phthisis, and among those so affected the duration of active service is only 8 years. On the other hand, less than half the white force of 25,000 goes underground and the 55% employed at surface is exceptionally healthy. Whatever may be said by philanthropic persons in London, labour unrest at Johannesburg is not explained by the instinct of self-preservation on the part of the worker or by sympathy on the part of his friends. In the first place, no man need work in the mines of the Rand unless he chooses to do so; he does choose to do so, because he is paid double the wages he would earn in other mining districts. Next, he is provided with respirators and water-sprays to minimize the danger from the impalpable particles of quartz, but he has been obstinate in his unwillingness to use them in self-protection. These preventives are now better understood and more generally used, and the Government has taken such pains to check and allay the phthisis evil that conditions are distinctly more favourable to health. But does the miner beg for protection to his lungs? No. He asks for bigger wages and shorter hours. Obviously, he is like the mine-owners in stretching a point to make money.

With both it is a scramble over a predominant share of the dwindling profits to be won from the gold in the seams of conglomerate.

Oil versus Coal.

The recent declaration of naval policy by the First Lord of the Admiralty has served to draw attention once more to the rival claims of oil and coal as sources of power. As usual, the public obtains a distorted or exaggerated view of technical questions. The heralding of oil as the universal fuel requires a salutatory counter-blast from the coal-owners. It is well for those not immediately interested in the rival camps to examine the situation disinterestedly. The economic position is in reality two-fold. In the first place, the Navy requires speed and fighting power regardless of cost, and manufacturing circles seek for anything that will reduce the cost of power. Coal presents many points of disadvantage as compared with oil when naval requirements are considered. It requires greater storage space, more men to trim and stoke, while the operation of coaling is tedious and tiring. The discharge from the coal-furnace provides a target for the enemy, unless the highest quality of South Wales coal is used. Oil has all these points in its favour as regards fighting efficiency. On the other hand, the limited resources of oil throughout the world and especially within easily accessible parts of the British Empire introduce unsatisfactory complications. Any extensive increase in the use of oil would send its price to a level disconcerting even to the Admiralty, and would in any case cause a serious competition for supplies. A corner in oil might place the rival governments at the mercy of the capitalist. With regard to English interests, it is obvious that a safe and regular source of supply is required. The Scottish shales are the only home source, and the other oil regions within the Empire are all far away, and some undependable. It would be impossible to make con-

tracts with countries likely to be naval rivals, such as the United States. Even Mexico and Ecuador come dangerously within the zone of influence of the United States. Such sources of supply as Russia and Roumania are, of course, quite out of the question.

There is one feature in connection with the use of coal in the Navy that is the basis of much misapprehension. Many people suppose that the oil is, or is to be, used in internal combustion engines. As a matter of fact, it will continue to be used solely for steam-raising purposes, for an indefinite period, for the Diesel engine has not yet been developed sufficiently in relation to high-speed of propulsion and ease of manœuvring.

From the commercial standpoint, it is desirable to remember that the world's resources of petroleum are small compared with those of coal. The yearly production of coal throughout the world is over one thousand million tons, or more than twenty times that of petroleum. The known resources of petroleum are estimated to last for not more than 50 years at the present rate of consumption; an insignificant life compared with the expectations of many coalfields in many countries. Water-power is the real rival of coal for fixed industrial businesses. For the protection of our trade and influence on the high seas at any cost, oil-fired furnaces and steam-engines have their place in the British Navy.

In the above remarks we have confined ourselves to the question of heavy oils. But there is, in addition, an important industry based on light oils, used for internal combustion in self-propelled vehicles, and in aeroplanes, hydroplanes, and motor-boats. The volatile products of the petroleum wells were found most adaptable for this application, because initial ignition can be obtained without previous heating. In this country the motor-spirit is called petrol, and in America gasoline. But during the last year or two the supply of this material has proved woefully

short for the requirements of the motor industry, and attention is now being turned to other sources of similar oils. For several years the English producers of benzol have had an excellent market on the Continent, and it is only recently that the Automobile Club in this country has made investigations into the applicability of this by-product of coke and gas manufacture for their purpose. Various companies have been formed for the purpose of producing the paraffin series from coal without distilling the heavier hydrocarbons, the expectation being to make a profit not only from these light oils but also by briquetting the remaining semi-coke and selling it as a smokeless fuel. Other manufacturers continue to distil the coal at high temperatures, either for gas or coke manufacture, and they have found the residual pitch to provide an important addition of income derived from the sale of benzol, in that it is in large demand for the construction of smooth and dustless roads. The use of alcohol and other spirits derived from vegetal and animal products is attracting the attention of those interested in the propulsion of light vehicles on the land, air, and sea, but this branch of power generation is of interest to the mining engineer in his leisure moments rather than in his professional capacity.

Hall's Sulphur Process.

Last month our New York correspondent gave a preliminary note concerning a new process for roasting sulphur ores, whereby the sulphur is recovered in elemental form instead of being discharged as sulphurous or sulphuric acid. This process has been developed by Mr. William A. Hall, an American industrial chemist, cousin of Mr. Charles Martin Hall, an inventor honourably connected with the metallurgy of aluminium. The sulphur-process patents are not completed, and in the meantime the details cannot be published. In principle the process consists of heating the ore in an ordin-

ary roasting-furnace, in an atmosphere of reducing gases and steam. The reaction is not newly discovered, even if its practical application has not been anticipated. It is well known that in the presence of hot carbonaceous matter and steam, pyrite parts with its sulphur in the form of sulphuretted hydrogen. For instance, in the carbonizing plant at a gas-works or in the coke-oven, the sulphide of iron present in the coal is converted into sulphuretted hydrogen. This gas may be caused to release its sulphur as flowers of sulphur in a variety of simple ways. At the gas-works iron oxide is used for fixing the sulphur from the gas. In other cases the purer forms of sulphuretted hydrogen may be partly burnt and the resulting sulphurous acid used to react with the rest of the sulphuretted hydrogen for the production of sulphur and water. It will be necessary to wait until the publication of the patents before Mr. Hall's method of procedure can be ascertained. Mr. Hall's original application of this idea was to improve the method used in Europe, and described in Agricola's *De Re Metallica*, of producing sulphur from pyrite, and subsequently the applicability of the process in connection with copper and lead smelting became obvious. In the United States many smelters have had to suspend operations on account of the opposition of the farmers. No method of diluting the discharged gases satisfied the agricultural interest, and as there was no market for sulphuric acid or supply of phosphates for the establishment of a fertilizer industry, there was no object gained in catching the sulphur gases. Moreover, if the sulphur were recovered as sulphuric acid, without a market for it, the store of acid would be a white elephant, a Frankenstein's monster, or an old man of the sea. If the sulphur were recovered as 'flowers' it could be stored without danger, and it could even be sold for next to nothing, seeing that the cost of its transport to market would be far less than that of carboys of acid. It is appropriate that the eco-

nomic value of the process should be tried at one of the smelters in the west of the United States that has been forced to close owing to the damage done to surrounding vegetation. This is the Balaklala smelter in Shasta county, California. The patent rights throughout the world have been acquired by the Sulphur Syndicate, Limited, an English company of which Mr. Theodore J. Hoover is chairman. The American, Canadian, and Mexican patents will be handed to an American corporation, the Federal Sulphur Co., and the patents for the rest of the world to the British Sulphur Co., a British corporation. An experimental plant is working at Edmonton in the north of London, and in America the process has been examined and worked by the professors in Columbia University, New York.

Bonanza, Nicaragua.

In accord with its policy of holding interests in other mines, the Camp Bird company acquired the control of the Santa Gertrudis, in Mexico, and a large participation in the Mesina copper mine, in the Transvaal. Now it is proposed to take a share-holding in a consolidation of gold mines in Nicaragua. These include the Bonanza-Mars, Lone Star, and Siempre Viva groups, all in the Pis Pis district, on the Atlantic slope of Nicaragua. The name of the company is to be the Central American Goldfields; it is capitalized at £1,000,000 in £1 shares, of which 130,000 together with £300,000 in cash will constitute the purchase price. A sum of £200,000 is set aside for working capital and the erection of a mill to have a capacity of 500 tons daily. The Camp Bird company is to take 300,000 shares. After allowing for the commission to the underwriters (30%, in shares) there will remain 220,000 shares unissued. The Bonanza mine is not unknown, for it has been under offer on sundry occasions during the last three years. Mr. J. H. Mackenzie, of San Francisco, examined the mine for himself, and his

associate, Mr. F. W. Bradley, in 1910. The price of the Bonanza-Mars group alone was then \$1,500,000. It was deemed excessive. Later, the owner, Mr. Joseph Lapierre, came to London and offered the business to various representatives of capital, including Messrs. H. C. Hoover, R. J. Frecheville, and R. T. Bayliss, but the price proved a hindrance to the consummation of a deal. Meanwhile, Mr. E. D. McDermott, while examining an adjoining property, the Siempre Viva, had visited the Bonanza, and expressed a favourable opinion on the district. Subsequently in New York, through Mr. James Deitrich, prominently identified with mining and railway enterprises in Nicaragua, the project came again to Mr. R. J. Frecheville, who took an option for the Canadian Agency, the company through which Mr. Arthur Grenfell and his associates promote financial enterprises. The Bonanza mine is one of importance. Oxidized ore and *manta* have been worked for 10 years by means of 5 Huntington mills of 3-ft. diameter, thereby earning from \$80,000 to \$120,000 annually in profit. The *manta* is the talus of eroded outcrop, such as is not uncommon in the tropics. Big orebodies assaying \$7 in gold and 8 to 18 feet wide, are said to exist. The property includes a water-right capable of generating 2000 horse-power. Among the drawbacks to the enterprise are the lack of transport and shortage of labour. The district is 12 days by canoe-transport from Bluefields, the cost of freight being 5 cents (gold) per pound. A narrow-gauge railway must be built. Labour for large-scale operations is lacking.

A report by Mr. Orvil R. Whitaker has been circulated, with an endorsement by Mr. R. J. Frecheville. These gentlemen agree in stating that there is "in sight" (a term that should not be used without careful definition) above the drainage-level 2,400,000 tons of positive and probable ore averaging \$6'66 per ton. 'Probable' ore is distinctly not 'in sight.' The operating cost is estimated at \$3'50 per

ton. A profit of \$5,000,000 is said to be reasonably assured. Each 100 feet of vertical development is expected to give 2,000,000 additional tons of ore. This may prove true, but further proof is required. It appears to us that the property is one of great merit, but in its present stage of development it is hardly adapted to joint-stock finance. In any case, it would be proper to protect the public by submitting reports by engineers not so closely allied to the vendors.

What is a Profession?

This question is often asked. It is worthy of a considerate answer, especially from those who claim to be members of the profession of mining engineering. We start with the definition that a profession consists of a number of persons professing to do something in particular. Not words, but deeds, are implied. The clergyman, for example, illustrates two meanings of 'profession.' He makes a profession or avowal of faith; here the reference is to a way of thinking, rather than to a manner of performance. It is true the cleric is credited with distinctive qualities helpful to holiness of life, and he is assumed to have technical skill in the advocacy of principles contributory to such holiness, but he is not supposed to occupy himself for the purpose of gain or the enjoyment of skill in the performance. His is an avocation or calling. In so far, however, as he undertakes to study divinity in order to prepare himself for preaching, he is training for a profession. On the whole, and omitting the idea of a profession of faith, we regard the clergyman's occupation as a high calling or avocation, not a profession, in the sense in which that word is applied to mining engineering. We consider the clergyman as *hors concours*, and prefer to make comparisons with the other two ancient and learned professions, those of law and medicine. By keeping them in our mind's eye, we advance to another differentiation. It is not

enough to do a particular thing ; the hod-carrier does that. A closer definition is required : the members of a profession do something in particular and with special skill, differentiating them from the mob of people who do various things in a variety of ways. Thus we get the idea of preparation for specific work. A profession is an occupation involving special attainments or special discipline, such as the law and the army. It calls for mental rather than manual labour ; thus the architect belongs to a profession but the bricklayer to a trade. A trade is learned or followed for subsistence or profit ; but, it may well be asked, does not this apply to a profession also ? No. A difference exists. We find it in the fact that the member of a profession is not only trained and educated to perform specific work in order to win an honourable livelihood, but he has such a love for his work that the doing of it *well* becomes part of his compensation. A butcher cuts meat in order to be paid by his customers ; a surgeon performs an operation in order to save life or to gain knowledge ; he receives monetary compensation for the performance, but that feature is secondary. A surgical operation is performed as carefully on a pauper as on a prince ; if it be done with less care in the one case than the other, then the surgeon becomes a butcher. The idea of doing a thing for the sake of doing it *well* is inherent in the spirit that makes a profession. Take the comparison between a plumber and an engineer. Why is the occupation of the one dubbed a trade, while that of the other is labelled a profession ? Both exact a monetary reward for their services, but the one is supposed to have more of an eye on payment than on excellence of execution. That is the basic difference. There may be plumbers who take pride in their work and do it well for its own sake ; and there are engineers who think so much of their fees and so little of the sincerity of their service as to be no better than tradesmen, but the characteristic of the plum-

ber is accounted the degradation of the engineer.

In order that the members of a profession may become proficient, they are given a special mental training. Hence the so-called learned professions—divinity, law, and medicine—involved a liberal education, which at one time meant the reading of ancient literature. The growth of modern science made a complete change in current ideas concerning a liberal education, and the application of science to industry multiplied the number of professions dependent on a high level of mental training. Engineering, more particularly, has grown so rapidly and so widely as to afford scope for a dozen sub-divisions of that profession, one of which is mining. Yet mining engineering is not given the respect accorded to law or medicine. Why ? Because it is allied too closely with the Stock Exchange. Is a stock-broker a member of a profession ? No. He is one who follows an occupation requiring unusual aptitude or uncommon dexterity, but no special training ; he differs from an ordinary labourer in that he requires to have brains and to use them, but his sole purpose is to buy and sell a commodity : bonds and shares. He is a trader. A mining engineer should differ from him in having undergone a training by instruction and apprenticeship, followed by special education, which means the drawing out of particular faculties, thereby preparing him for the application of engineering to the extraction of the metals from ore deposits. He also, of course, expects gain, in the form of fees and salaries, but it is expected of him that he will not make these the sole aim of his activities. He is supposed, like a surgeon, to perform his work *well* for its own sake, because he loves it. When he does it for pay only, he is no better than a plumber or a grocer, except for his special training. This enables him to perform an allotted task and to earn a living, but, without the fine enthusiasm implicit in a pro-

fession; he becomes only a 'professional,' the man who does a thing for pay. When an engineer accepts commissions and takes part in the promotion of companies for speculative dealings, he is not necessarily debased thereby, but he is differentiated at once from the members of a profession. It is not inherently degrading to do things for money any more than it is inherently ennobling to do things for sloppy sentiment, but, on the whole, the spirit that prompts the proper performance of an action for the sake of skill, usefulness, or honour, is finer than that which is done for the purpose of accumulating shekels. Thus, finally, we arrive at our definition: A profession is an occupation involving a special training and a high purpose, leading to the performance of technical work efficiently.

Esperanza.

Letters from Mexican shareholders, and from an engineer representing such shareholders, have prompted critical remarks in the financial press. With such dissatisfaction we have a good deal of sympathy, for the Esperanza has undergone strange vicissitudes of fortune, and must have caused disappointments at least as intense as the surprises due to the sudden discoveries of rich orebodies. After being for a long time the least valued of the group of famous mines at El Oro, the Esperanza sprang into immediate fame through the uncovering of an extraordinary bonanza in 1904. At that time the mine was operated by an Anglo-American company controlled by the Guggenheims. The main vein, the San Rafael, had proved disappointing, and shareholders were not cheerful. In August, 1904, a drill-hole, followed by a cross-cut on the third level, intersected a new lode, called the West vein, which proved extraordinarily rich. This discovery was mentioned by Mr. R. T. Bayliss at the El Oro Mining and Railway Co.'s meeting in October, but the big rise in Esperanza shares did not begin until the spring of the

following year. Information from the mine was slow in coming to the general body of shareholders. The discovery made an instant change in the fortunes of the enterprise, the shares reflecting the fact by rising from below £1 to over £6. The total output of the mine has been 1,886,000 tons containing \$32,642,000 in gold and silver. Dividends have aggregated £5 6s. 6d. per £1 share, equivalent to 532½%. In 1907 the mine appeared to be on the verge of exhaustion, for Messrs. Cortlandt E. Palmer and A. Chester Beatty, the consulting engineers, reported that the ore assured was only 65,485 tons, from which about \$225,000 of operating profit was obtainable, and that "the probable ore should double this figure." Early in 1908 the present manager, Mr. Charles Hoyle, was appointed. Since then the dividends, not the so-called operating profits, have totalled £773,000, or 170% on the capital of the company. This unexpectedly good result, after the mine seemed on its last legs, exemplifies the possibilities of the property and justifies the persistent effort to discover fresh ore-bearing ground by systematic exploration. Despite such effort, made under the advice of Mr. H. A. Titcomb, now consulting engineer, the outlook has become increasingly gloomy, and, as is often the case when the fortunes of a mine are on the wane, it has become the subject of unjust criticism. We are not prejudiced in favour of the directorate, and we recognize that the unloading of shares by the Guggenheims, entailing a return of control to London, has antagonized many of the surviving shareholders, but we have good reason to believe that the company's business is being well conducted, by the resident manager, by the consulting engineer, and by the board. The only weak point in the management is the lack of explicit information and the insufficient care taken to render information readily intelligible. It has not been clear how much of the San Carlos ore was being treated, or why apparently unprofitable ore was being

broken elsewhere in the mine. As regards the latter, we learn that it is true that a loss has been incurred on 1000 to 1500 tons of material broken monthly in the course of development, that is, if the full operating cost is charged against such material, but it had to be broken in the course of exploratory work, and it contained more than enough gold and silver to meet the expense of tramming, hoisting, and milling; so that, once broken, it yielded a small profit, while at the same time the removal of it was incidental to the search for better ore. There are no false economics here. For the last year about 20% of the whole tonnage has come from the San Carlos vein, and during the current year the bulk of the ore milled has been derived from that vein in course of development and stoping. Of course, if the ore now developed on the San Carlos could be extracted forthwith, and the mine gutted, the assured profit would be larger, but with it would be lost the opportunity to test promising places in the old upper workings and to keep the mine alive in the hope of a favourable turn. The San Carlos is a small and patchy vein; the difficulty of working it is increased by the fact that the miners of El Oro are accustomed to large stope-widths; they have not learned how to break small veins without including a large proportion of wall-rock, especially when the encasing rock is soft and the ore intermixed with shale. Moreover, the San Carlos ore is baser than that from the older workings. It contains enough copper to foul the cyanide solution, so that the extraction drops to 70% as against 90 to 93% on the oxidized ore. When the railway was blocked recently and it became impracticable to make shipments of concentrate, this ore had to go direct to the cyanide plant, spoiling its efficiency. In May the extraction was 85%, this being an average of the results obtained from San Carlos ore and the oxidized stuff from the upper levels. Hence some disquieting and contradictory mill-returns. Into these Mr.

Godfrey Doveton is now making expert inquiry, with a view to suggesting some change of treatment.

Great mines die hard. The vicinity of a rich orebody is promising territory. It is no wonder that the management seeks to prolong the life of the enterprise, in the hope that some fortunate discovery may give renewed vitality. It is likely that the advice of a geological specialist may be asked, in conjunction with the consulting engineer. A diagnosis of a patient by a specialist is more useful, to the patient, than an autopsy just before the funeral. We doubt whether a mining geologist could help the management, for the ore deposits of El Oro give signs, in every one of the productive mines, of exhaustion in depth. The petrography, as regards more andesite and less shale, is becoming unkindly; the country-rock is harder, the veins are tighter, and the distribution of precious metal is more patchy. Such evidence as is now available is decidedly unfavourable, but, even if it be so, there is so much at stake that hasty conclusions would be highly unwise. We suggest that the four principal companies, all alike interested in gaining light on the subject, should unite in engaging a highly competent mining geologist to study the conditions underground and so afford advice in regard to deeper exploration.

The R.S.M. Association.

On July 22 a general meeting of graduates from the Royal School of Mines gave effective endorsement to the organization of an association of former students and teachers in the principal mining college of the Empire. As the Royal School of Mines was founded in 1851, it can be said that this step has been taken deliberately. However, the organization has been formed at a date when it is assured of a large membership, and, it is hoped, enthusiastic support. The old School has passed through strange vicissitudes; it has been driven from pillar to post, from Jermyn

Street to South Kensington; it has been affiliated, annexed, and almost smothered by successive arrangements arising from the general growth of technical education. If the association of old students had been organized more promptly it is possible that the fortunes of the School might look brighter today; but the final turn in its history has not yet been reached, another crisis is impending, and loyal effort is yet required. Not that the organization of old students was formed with a belligerent purpose; it is primarily intended, so says the official declaration, "to foster comradeship" among the alumni. After that it hopes "to advance the interests," and finally it intends "to express the opinion" of those having at heart the welfare of the R.S.M.—by which initials it is usually known in the mining profession. Membership is on broad lines, for it includes all who have either studied or taught in the School for one year or more. The chairman at the inaugural meeting was Mr. William Gowland F.R.S., A.R.S.M. As Professor Emeritus and Associate he is admirably representative of the earnest student and the effective teacher. Those who took part in the proceedings and those who constitute the general committee are splendidly representative of the manifold activities and diverse professional success attained by the men who give allegiance to the crown and crossed hammers. The general committee consists of 18, of whom 6 retire annually, thereby establishing the idea of rotation. The executive committee for the first year consists of Messrs. E. T. McCarthy, Ernst Lichtenberg, Frank Merricks, S. J. Truscott, and Guy S. M. Taylor, with the president and honorary secretary, *ex officio*. The first president is Mr. William Gowland, and the prospective presidents are Mr. William Frecheville and Mr. E. T. McCarthy, who are now, respectively, first and second vice-presidents. The secretary is Mr. T. A. Rickard, who is prepared to devote himself heartily to the work in hand. A good start has been made; six-

teen subscriptions of £25 each have been received for honorary life-membership, and ordinary members at half-a-guinea per annum are being enrolled daily. It is hoped that 10 or 20 more old R.S.M. men will become life-members on the basis of donating £25, so that the organization can be placed on a safe financial basis. The current expense will be small. With the money subscribed it is hoped to aid young graduates in making a start and in giving assistance to necessitous students of high character. Uses for money are not likely to be lacking, and in any event no organization can expect to be either respected or self-respecting if it is impecunious. Against that contingency the Association is fairly assured by the money already received, but it must depend for its vigour on the annual revenue derived from the subscriptions of ordinary members. We urge all R.S.M. men to join at once and to ask their class-mates to join. No letters or circulars of solicitation will be issued. If the scheme is a good one, it will receive voluntary support. For that it appeals herewith. The time has gone for dinners and talk; if the men of the Royal School of Mines are not glad to subscribe annually the price of a theatre-ticket toward the cause of their old college, and if they are unwilling to enrol themselves in this association of their comrades, then the Royal School of Mines may go to the scrap-heap and all we shall ask is a first-class wake to celebrate the funeral of an institution to which are linked the names of Tyndall and Huxley, Ramsay and Judd, Percy and Le Neve Foster, and a score of the most honoured names in modern technical science. Gentlemen of the Royal School of Mines, which is it to be? Shall after-dinner loyalty prove but the froth on the wine-cup, or shall it be shown once and for all that yours is a Royal School not by grace of kingly patronage but by the affectionate allegiance and instant support that your *alma mater* can evoke among you? Gentlemen, it is up to you.

ROYAL SCHOOL OF MINES

The Association.—At the general meeting on July 22 the proposals for the organization of an R. S. M. Association were formally ratified. Professor William Gowland, F.R.S., presided. After he had given an admirable summary of what had already been accomplished, and after the Hon. Secretary (T. A. Rickard) had made some supplementary remarks, the following representative men spoke in favour of the scheme: T. C. Cloud, H. F. Marriott, W. A. Carlyle, Harold Jeans, Rowland Feilding, and W. F. A. Thomae. It was proposed and seconded by Messrs. S. J. Speak and E. R. Woakes that the action of the committee, in taking preliminary steps to form an old students' association, be ratified and endorsed enthusiastically. Professor W. H. Merrett proposed, and Professor C. O. Bannister seconded, a motion confirming the election of the general committee. This consists of 18, namely, William Gowland, A. G. Charleton, S. H. Cox, D. A. Louis, Frank Merricks, J. J. Beringer for one year; William Frecheville, Sir Thomas Holland, G. T. Holloway, Bedford McNeill, Ernst Lichtenberg, and Guy S. M. Taylor for two years; and E. T. McCarthy, F. W. Harbord, H. W. Hughes, S. J. Truscott, Donald Campbell, and J. M. Beckwith for three years. A cordial vote of thanks to the chairman was proposed by Mr. E. T. McCarthy and seconded by Mr. F. W. Harbord. After the meeting many of those present were enrolled as members. Already 16 donations of £25 have been received, besides others for smaller amounts. Ordinary members at half-a-guinea per annum are joining rapidly.

New Professor.—The appointment to the chair of metallurgy has been given to H. C. H. Carpenter, now professor of metallurgy in the University of Manchester. Although only 38 years old, Professor Carpenter has had a

distinguished academic career, having obtained degrees both at Oxford and Leipzig universities, besides being awarded sundry scholarships and medals. He is, we are informed, not only a man of engaging personality, but a teacher gifted with the art of exposition, so that he should prove a highly successful professor. Hitherto his work has been chiefly with iron and steel; in consequence, the Governors of the Imperial College have arranged for Mr. Carpenter to study the most recent developments in non-ferrous metallurgy, not only at home but also on the Continent and in America. He will not take full charge of the metallurgical department at South Kensington until September 1915. Meanwhile, the Professor Emeritus, Mr. William Gowland, F.R.S., A.R.S.M., will assume the duties surrendered by Mr. W. A. Carlyle, A.R.S.M. These arrangements seem to us to be eminently sagacious and augur well for the efficiency of the metallurgical instruction at the Royal School of Mines.

Another Appointment.—We are informed that Mr. S. J. Truscott, A.R.S.M., has been appointed assistant to the professor of mining, Mr. William Frecheville, A.R.S.M. This appointment has been well received, for it is regarded as promising a continuity of teaching. Mr. Truscott is an engineer of high standing and attainments, he is a pleasant speaker and an earnest student of technology. The experience gained by him, notably in Sumatra, the Malay States, and South Africa, will furnish him with a background of realities greatly helpful to effective instruction. His own academic career was distinguished, for he won both the Murchison prize and the De la Beche medal at the Royal School of Mines in 1888 and 1889. As he is only 42 years old, he may look forward to a long period of useful service.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

July 1913	June 1913	July 1912
£64. 5s. 10d.	£65. 4s. 6d.	£76. 13s. 10d.

In spite of a favourable statistical position, the month commenced with a weaker tendency in prices. Sentiment is dominated almost exclusively by the fears of a halt in trade activity, to which the Balkan situation gives birth; and although trade returns provide no cause for alarm, yet the possibility is ever present of an extension of hostilities in fresh directions. The long period of depression and of falling prices, the smallness of available supplies, and the enormous trade consumption required only the stimulus of public interest to create a strong market. This interest was provided by the outbreak of the strike in the Lake copper region where the whole of the miners are out. An early settlement is not expected. This influence gave the turn to the market, which had fallen to £62. 10s. for standard. Large European dealers took substantial lines of electrolytic from American producers, and were in turn relieved of their purchases by the trade, which had been encouraged by their example. While public speculation remains entirely absent, consumers have continued to buy right up to the end of the month, and the market still looks strong. It is believed that 50,000 tons was sold in 10 days. The producers have raised their prices steadily, and from 14 c. gradually advanced to 15½ to ⅜ c. Standard at the same time rose to £67. 10s.

TIN.

Average prices of cash standard tin :

July 1913	June 1913	July 1912
£183. 16s. 11d.	£204. 9s. 1d.	£202. 8s. 3d.

The market has been heavy on the whole, and the price at one time touched £177. There was no evidence, however, apart from the usual manipulation on the eve of the Banka sale, that the prominent interests were definitely committed to either side. The average price realized at the auction was £185. 5s. Operators professed disappointment at the result, and straightway offered down to £180, from which level a recovery is now in progress. The figures at the end of July showed an increase of 812 tons in visible supply, which is better than expected. At the same time the position is explained by the small ship-

ments from the Straits which it is asserted will show a corresponding increase for August. The Welsh tinplate trade is poor, and American purchasing is restrained.

LEAD.

Average prices of soft foreign lead :

July 1913	June 1913	July 1912
£19. 7s. 10d.	£19. 10s. 8d.	£18. 8s. 9d.

A somewhat firmer tone prevailed during July, but without any pronounced buying movement. The scarcity of supplies is still acutely felt, and spot metal commands a premium of anything from 5s. to 20s. per ton. For August, shipments are coming forward more freely, and the tension should be relieved; but as the Mexican position shows no improvement no slump in prices can be expected. Bear speculators who sold heavily in June and July have still to cover, and their influence should sustain prices in weak moments. The trade is buying with restraint.

SPELTER.

Average prices of good ordinary brands :

July 1913	June 1913	July 1912
£20. 11s. 2d.	£21. 19s. 10d.	£25. 13s. 1d.

Great activity has prevailed on the London metal exchange where unusually large business has been put through. The galvanizing trade has booked some good orders, and has been covering spelter against them with some freedom, so that the syndicate has felt emboldened to raise its quotations. The importance of the London market, in spite of the efforts of the syndicate, appears to be growing and dealers are taking full advantage of the facilities afforded them.

OTHER METALS AND MINERALS.

Prices quoted on August 10 :

SILVER.—27½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £90 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£28 to £31 per ton.

QUICKSILVER.—£7. 5s. per flask.

MANGANESE ORE.—9½d. to 11½d. per unit.

IRON ORE.—Cumberland hematite 26s. per ton at mine. Spanish 20s. delivered.

PIG IRON.—Cleveland 55s. per ton. Hematite 73s. per ton.

WOLFRAM ORE.—34s. 6d. per unit (1%).

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

JOHANNESBURG.

The Strike, which began so simply and quietly at the New Kleinfontein, developed into an agitation of a magnitude to surprise everyone, even the agitators themselves. It is difficult to account for the startling solidarity of labour, so much in evidence toward the close of the struggle, but it may be attributed to well organized intimidation backed up by socialistic ideas fashionable in labour circles and quickened by the bitter knowledge that under prevailing conditions life is short—underground. The result has been a complete victory for the trades-unions; and now signs are not wanting that the industry will have to submit to a burden of unintelligent dictation reminiscent of Australia at its worst. Of the regrettable incidents in Johannesburg little fresh can be said. The authorities perhaps pulled the reins a little too tightly in stopping the big meeting in the Market Square, but had it not been for the sharp lesson administered by the troops, the loss of life might have been very much greater, and the forces of hooliganism would have caused vastly greater destruction, and perhaps reduced the business centre of the town to ruins. The effect on the mining industry will be to raise working costs, as the workers will now demand, and obtain, certain reforms which, while bettering their conditions, will prove expensive alterations; and the higher staff positions will be more and more filled by men who have a wider knowledge of their kind than the conventional mining engineer or financier possesses. The immediate danger is that the labour leaders, flushed with success, will lose their heads and formulate extravagant demands which no sane man would ever think of acceding to, but it is hoped that common sense will prevail, and that matters will be allowed to progress on decent constitutional lines.

Recent happenings have proved conclusively that there is much room for improvement in the relations existing between the employees on the mines and the head-office officials of the groups that control them. There is on many mines a feeling perhaps a little antagonistic toward the head office. The staff of a mine as often as not regards its head office as a soulless machine for the propagation of autocratic and inconvenient decrees, and

for the taxing of the time of the mine-staff in the preparation of voluminous statistical returns and elaborate plans, the need for which is not apparent. Obedience to a head-office ukase is necessarily forthcoming, but it is not always willingly tendered. This inimical undercurrent seldom manifests itself by spoken, still less by written, word to the head-office representative, especially if he is an all-powerful one, as the result might be inconvenient to the speaker from the wage-earning standpoint; it does, however, show itself sufficiently to make an observant person aware of its existence. It is a pity that such a gulf should exist; the mine and its head office are mutually dependent, and it is for the good of both and of the industry that a good understanding should be maintained. The question then arises how best closer union can be effected. Many suggestions have been made, some worth careful consideration and some worth none. A few of the best may be quoted. The directors of a mine should visit it once or twice a year and go underground. The consulting engineer should inspect the surface works at least once a month, and at the same time visit one or two of the more important workings underground. If these gentlemen are too busy to do this, it will show that their departments require re-organization. Other visits of inspection and assistance by other officials will be made wherever desirable or necessary to clear up technical points of practice, the whole idea being to keep the head office in close touch with what is going on, to give sympathetic advice and technical assistance to any official on the mine requiring it, and so to demonstrate that the control is an active and helpful one, and that a head-office man is not the unapproachable being playing with the destinies of mine-workers, as gossip pictures him, but one almost as approachable and companionable as if he lived on the mine and worked there. An exchange of officials now and then between mine and town would also lessen friction and greatly facilitate matters. Another suggestion is that some life should be put into the annual meetings, which at present are as stimulating as the meetings of a burial board. A 'representative' gathering of a few directors, a secretary, a shivering shareholder, and a bored office-boy may be

called the annual meeting of shareholders, but it constitutes something in the nature of a farce to the average onlooker. As it is well nigh impossible for European shareholders to be present, these meetings might be utilized to promote closer union by holding them in the recreation halls of the mines concerned and requesting all members of the mine-staff to attend. Some such innovations are certainly worth trying if those in control are really desirous of cultivating a heartier co-operation between town and mine than exists at present; and indeed they would be well advised to study how best to vitalize their machine-made methods of administration if they wish for commercial peace.

The City Deep seems a worthy successor to the Crown Mines as an example of bad estimation, but it is to be hoped that it will, unlike the latter company, be able to avoid hanging a millstone of debenture debt round its neck. At the annual meeting held on March 29, 1911, the chairman said: "We hope to attain the full crushing capacity of the mill, which is in the neighbourhood of 65,000 tons a month, towards the end of this year"; and he went on to say that "the mine is, therefore, in an exceptionally strong position; success on a large scale is assured; it is only a question of a few months more before we get into our stride." This prophecy having been completely falsified by events, a new one was delivered on May 30, 1912, in the following terms: "It is hoped that the company will be crushing the full 60,000 tons at about the end of the year." This hope also withered in the bud, and on June 5, 1913, the chairman remarked: "Our consulting engineer reckons that the mine should be able to supply the whole mill output on single shift only within a period of fifteen months or so." The question, however, is not when the mine *should* be able to supply the whole mill, but when it is going to supply the whole mill; and current opinion is inclined to allow from two to three years from date as the time required to develop the mine on a scale commensurate with its reduction plant. The reason for this long delay in fulfilling expectations is accounted for by the unprepared state of the mine when milling started in December, 1910, and the shortage of native labour, which has prevented it from catching up, and still does so. In a wild endeavour to remedy this state of things, manager after manager has been sent 'on leave' with little apparent betterment as a result, and the mine is thus acquiring an unenviable notoriety in managerial circles in con-

nection with insecurity of tenure, a reputation which even the building of a mining township on its estate does not entirely dispel. In 1912 a total working profit of £292,654 was made, a dividend of 12½% declared on the capital of £1,250,000, and a cash balance of £65,272 carried forward to 1913. The fully developed ore reserve amounted to 1,750,000 mining tons of the excellent average of 8·8 dwt., and as showing the satisfactory nature of development the average of all disclosures on the Main Reef Leader, the chief lode of the mine during 1912, was 24·3 dwt. over 21 in. or 510 inch-dwt., and recent development returns have shown an improvement on that. There is, therefore, no doubt whatever as to the value of the mine, but there is a great deal of doubt as to the precise number of years that will elapse before the mine is able to do justice to itself. Working profits this year have been averaging, with sundry revenue, about £29,500 per month, which, allowing for cash brought forward and a distribution of 60% of working profit, would permit of a dividend of 20% for the year. A dividend of 10% was declared in June, and another of the same amount in December would therefore appear to be probable.

West Rand Consolidated Mines is a large amalgamation groaning under a load of £1,979,424 issued ordinary shares, £25,000 deferred shares, and £500,000 6% debentures, and as its property is not situated in a section noted for auriferous favouritism, it is scarcely surprising to learn that one dividend of 3¼% is all that operations have so far enabled it to disburse to shareholders. The gross working profit in 1911 was £58,328, in 1912 it was £86,235, and in the current year it gives promise of mounting to £120,000. The ore reserve at the end of 1911 was 1,003,000 mining tons of 5·25 dwt., and at the end of 1912, 1,116,733 mining tons of 6·02 dwt. This encouraging increase in the assay-value of the reserve, amounting to 3s. 3d. per ton, is due to good developments on the Battery reef. This banket outcrops several thousand feet to the south of the Botha or Main Reef series, which it overlies, and the workings in it form a separate mine. The plant has a capacity of 33,000 tons per month, and designs and estimates have been prepared for an extension to 60,000 tons per month, but no orders for machinery will be placed until the ore reserve position justifies the larger scale operation of the mine. It is expected that the period of preparation will occupy two years, and it is doubtful, considering the large expenditure necessary, if any di-

vidends will be forthcoming during this transition stage or for some little time after the enlarged plant is running. Active advance development is now proceeding, and in the Main Reef mine the lower levels are being driven to allow of backs of 900 feet. The Main Reef series contributes 85% of the ore, and the Battery reef 15%, the proportions broken by hand and machine being about equal. In 1914 redemption of debentures at the rate of £25,000 per annum commences, in addition to the £30,000 now being annually paid in interest. There is an unappropriated balance of £107,868, and liquid assets, less liabilities, amount to £263,277. The outlook for the

traced coincident with the packing of all waste below. After the mine had been successfully gutted, a few tons of accumulated slime remained for treatment, and what ore could be scratched out of the Treasury. Now the Treasury is closed-down, and thus the two mines have reached the end of their mining career. The Jumpers company, after vain attempts to find another mine in Rhodesia and Lydenburg, invested its surplus cash in the Benoni Consolidated, and it holds 102,700 of the shares of that ill fated company. It will consequently still exist in name, though the present price of Benoni shares would lead one to surmise that it might with advantage have



THE TREASURY MINE.

company is certainly better than it was a year ago, but it has a long road to travel before it can claim to be a success.

Jumpers & Treasury.—The workers having gone on strike, the permanent closing-down of the Treasury mine has been precipitated, for the small amount of payable ore remaining unworked will make it economically impossible ever to resume operations. These two mines have been operated under one management since November 1910, but the results of joint operation fell far below expectations owing to high working cost and too much of the ore proving unprofitable. The Jumpers is one of the oldest mines in the gold-field, and in its later days it experienced a burst of profitable activity by the introduction of the 'resuing' and fossicking style of mining, which enabled every ton of ore to be ex-

followed the more certain course of enriching its shareholders right away.

The Robinson Deep failed last year to secure as good results as in the previous year, as the following comparative figures show:

	Year ending March 31, 1912.	Year ending March 31, 1913.
Capital £1,000,000 in £1 shares, all issued.		
Gross working profit	£441,180	£384,638
Dividend	32½%	27½%
Tons crushed.....	594,800	623,800
Yield per ton.....	31s. 10d.	29s. 6d.
Cost „ „	17s. 7d.	17s. 9d.
Profit „ „	14s. 4d.	11s. 9d.
Balance of appropriation account	£125,794	£118,342

The reduction in working profit may be attributed to the inclusion of a larger proportion of low-grade reclamation ore, excess expenditure on renewal of plant, and heavy expense of timbering and packing the working places.

This mine has suffered severely from bursting pillars and foot-walls, and elaborate safety measures have to be taken to prevent accidents. During the last financial year 48 white men and 208 natives were kept daily employed on this safety-work at a total cost of £35,309. Sand-filling has now been started, in the hope that it may prove more efficacious and less costly. The fully developed ore reserve was given in the previous year as 1,141,000 milling tons of 7.0 dwt. assay-value, and in the year under review as 1,538,000 mining tons of 6.0 dwt. If these averages are compared on the milling basis it will be seen that there has been a fall of about 0.33 dwt., or 1s. 5d. in the assay-value per ton of the reserve. Prospects for the current year are fairly satisfactory. Owing to the increased labour force, the tonnage crushed has risen, but the yield per ton and profit per ton have dropped, and it looks as if this year's gross working profit will show a slight improvement, but scarcely sufficient to affect the dividend rate. It is interesting to note that this mine uses hand-labour for breaking to the extent of only 3.5% of the ore mined, machines being responsible for the remainder, and that this policy has proved highly successful, as shown by the moderate working cost of 16s. now ruling.

TORONTO.

Porcupine.—Since the termination of the strike the mines have settled down to steady work, and while there is a marked absence of the reports of new discoveries characteristic of the earlier days of the boom, the producing companies are increasing their equipment to an extent that indicates the substantial progress of the industry and foreshadows a large increase of output. There are now either completed or in course of erection 11 stamp-mills with a combined capacity of 1665 tons per day. About 175 stamps in all are now regularly in operation, and, if the plans now in hand for extensions are carried out, the number will be at least doubled in the course of a year. The principal increases under way are those of the Dome, from 40 to 100 stamps, the Hollinger, from 40 to 80, the Dome Lake and Porcupine Crown, formerly the McEnaney, each from 10 to 40. The Jupiter and Three Nations will each bring their capacity up to 25 stamps, and the Rea and Hughes will have 20-stamp mills. The regular 4-weekly report of the Hollinger for the period ending June 17 shows profits of \$124,015, leaving a surplus of \$34,000 over dividend requirements. Work-

ing costs have been reduced to \$5.47 per ton, and further economies are promised consequent upon successful underground development. The winze put down on No. 1 vein has reached a depth of 74 ft. below the 300-ft. level, at which depth the gold content was well maintained. This month the entire working force was put on an 8-hour day basis without reduction in wages, anticipating the operation of the recent amendment to the Mining Act, which comes into effect in January. The Hughes has completed sinking to the 300-ft. level, at which depth a promising vein 10 to 12 ft. wide showing free gold has been encountered. Cyanidation will be adopted in connection with the contemplated new mill. At the Dome Lake a new vein, with a good showing of free gold, has been struck in cross-cutting at the 180-ft. level. Bush fires, which, at the beginning of the month, over-ran a large area of the Porcupine region, resulted in the explosion of the powder-magazine of the Pearl Lake mine, causing considerable damage to the plant, but without injury to anyone. The McIntyre has begun sinking on No. 4 and 5 shafts, which it is proposed to put down to about 700 feet.

Kirkland Lake.—This area is now the principal centre of attraction, owing to reports of rich strikes and the fine showing made by the pioneer mine, the Foster (formerly the Tough-Oakes). The first clean-up from the 5-stamp mill, after a month's run, during which about 10 tons daily were treated, yielded 350 oz. of gold. The recovery made by the mill was very poor, as about \$10 of gold per ton went into the tailing, showing that the ore cannot be satisfactorily treated by amalgamation alone, and that more expensive machinery will be required. The shaft of the Foster is now down over 170 ft. in about 9 in. of high-grade ore in addition to good milling ore. Mining men are flocking into the district, and numerous finds are reported. On the Burnside property, adjoining the Foster, a surface vein showing free gold is being developed, and an ore-shoot has been opened which is stated to be high-grade. The Teck-Hughes has a shaft down on No. 1 vein for 120 ft., and is running a level at 100 ft., and is sinking on No. 2 vein, which makes a fine showing of free gold. The Wright-Hargraves claims, regarded as one of the most promising properties in the district, have been taken over on option by Burr Cartwright and associates. The Government road from Swastika to the Kirkland Lake area is being rapidly pushed to completion.

Cobalt.—The financial statement of the La Rose Consolidated for the half-year ended June 30 shows gross earnings of \$811,588, expenses \$334,920, and net profits \$476,968. After providing for the payment of dividends, \$80,958 was added to the surplus. The total surplus amounted to \$1,831,298, of which \$1,507,562 was in cash. During June the output of the Nipissing was of an estimated net value of \$215,418. The Temiskaming is in rich ore at the bottom of a winze 40 ft. be-

cial proceedings to M. B. Sullivan, of Boston, for \$300,000. The Silver Cliff, now being operated by the Orion Realty & Investment Co. of Toronto, cleared \$15,000 on a carload of 18 tons of ore shipped last month, and will shortly make another shipment. The Wettlaufer, of South Lorrain, has considerably improved its position recently, having on July 11 cash in hand to the amount of \$158,631, and silver in transit or ready for shipment valued at \$60,000. Ore development has not

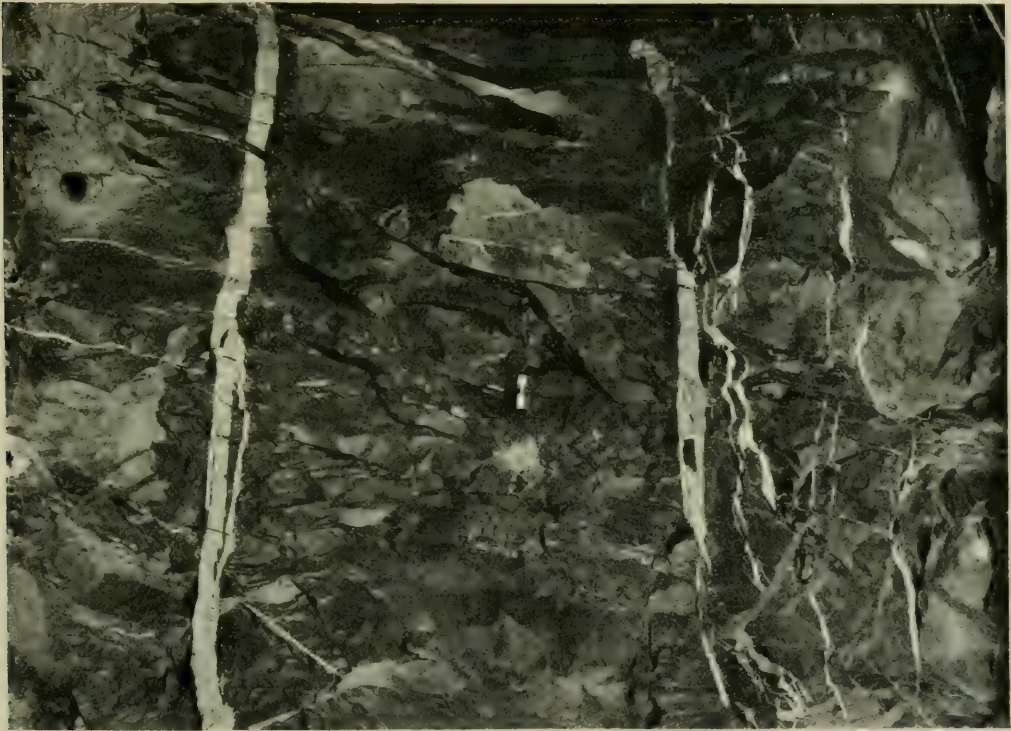


Photo by]

VEINS OF CALCITE RICH IN SILVER

[A. A. Cole

Traversing Huronian conglomerate in the Coniagas mine, Cobalt. The candlestick is 10 in. long.

low the 575-ft. level, in a vein in the diabase 6 in. wide. Good milling ore is being worked on another vein at 650 ft. A winze put down 20 ft. from this level is in good ore. The Seneca Superior has been put on a regular dividend basis of 10% every two months. The company has shipped 975,000 oz. since November 11 last. The Cochrane is extracting ore running between 2000 and 3000 oz. per ton from the 200-ft. level, and has ore blocked out between the 100 and 200-ft. level valued at \$250,000, exclusive of milling ore. The Sterling mine, which has been the subject of protracted litigation, has been sold under judi-

been satisfactory, and a contract has been let for diamond-drilling in the hope of discovering new resources.

DENVER.

Colorado is still waiting for a new mining district, but in a distinctly hopeful frame of mind. While irrigation enterprise and real estate speculation languish, there is more genuine effort to find mines in Colorado than there has been for some years. Platoro, in Conejos county, contains considerable ore of low grade. Whether on being re-opened the mines will do well is still uncertain, but the excellent results

at the Stratton's Independence, Portland, and Golden Cycle mines in the Cripple Creek district make the public much more ready to consider low-grade mines than a year ago. The second district that is being advertised is Eagle. Here rich silver ore was found last December; on the facts becoming known there was a small rush and many claims were staked on the snow last February. The snow is now gone and prospecting is on in earnest, there being 50 to 75 men in the district. There is only one shipping mine as yet, the Lady Belle, which has sent out about 600 tons of silicious ore containing 100 to 120 oz. silver per ton. The ore occurs in a 5-ft. bed of earthy sandstone, dipping at a low angle into the hill, and intersected by nearly vertical fissures of no great size or apparent importance. The mineralization extends from these fissures into the sandstone bed, and, in places, from one set of fissures to another. Dikes of igneous rock are known in the region, but not in any close relation to the veins. While the actual ore as yet assured in this mine is not large there seem to be good chances of finding extensions of the ore-shoot and even of other shoots. There is a large area in which similar rocks occur and which warrants careful prospecting. It is this that renders the find significant, together with the facts that the ore requires no milling and that the smelters have been short of silicious ore since cyanidation became supreme at Cripple Creek.

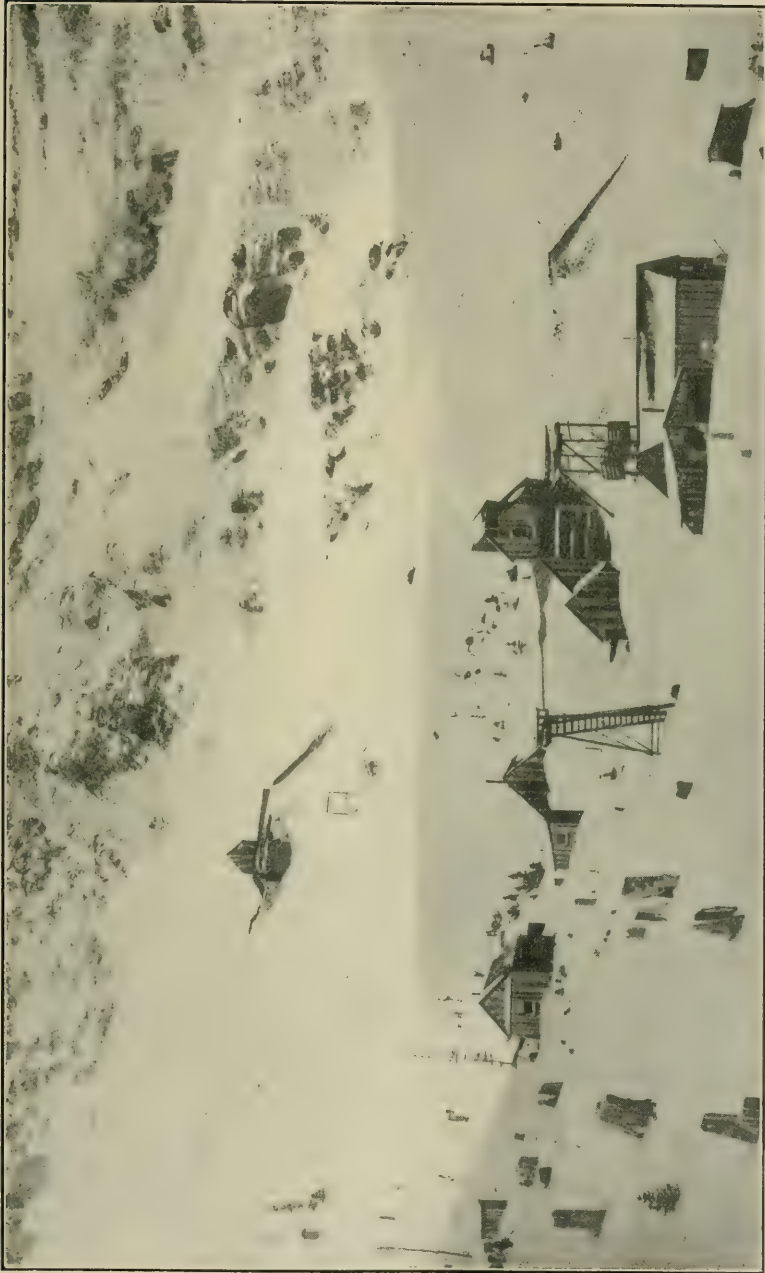
The older districts in Colorado are doing better than might be supposed from the woe-ful tales that have gone out. Indeed, in the San Juan some excellent orebodies have been found, and as intimated, Cripple Creek is turning out a large tonnage. In Gilpin county serious attention is being devoted to pitchblende ores and in the German & Belcher a considerable body has been disclosed. Forbes Rickard, who is in charge, described the occurrence recently in the *Mining and Scientific Press*. No shipments have been made, but ore is being rapidly accumulated. If a sufficient quantity is found, it is planned to build a refinery at Denver. It is known that in Austria the known deposits are being rapidly worked out and the carnotite deposits, in the United States at least, have not yielded the grade of ore that was at first expected. The field for pitchblende would seem, therefore, especially good, though the Gilpin county venture is being financed by men who are more concerned with the humanitarian aspects of radium production than with adding to fortunes already sufficiently generous.

Politics has got into the State School of Mines and there has been a change in the presidency. Victor C. Alderson, who has guided the school through ten years or more of storms, has been succeeded by Regis Chauvenet, as Emeritus President, and Professor Haldane as acting president. Nothing is to be said against either of these gentlemen except the conditions under which they take office. Mr. Alderson himself succeeded Mr. Chauvenet when the latter's resignation was forced, and the present movement is an effort to turn back the hands of the clock. The Colorado School of Mines has done excellent work and has grown with the years, perhaps never more rapidly than while Mr. Alderson was in charge, but it has grown despite continual factional fights in the faculty and occasional incursions of politics from outside, as now. It is a sorry example of how matters that should touch professional pride deeply become the sport of chance and politics. In Missouri a similar condition obtains and the capable and active director of the School of Mines at Rolla, L. E. Young, has just resigned as an emphatic protest.

SAN FRANCISCO.

Quicksilver.—Reports from Nevada indicate that the production of quicksilver promises to become an important industry. A recent dispatch from Mina states that a 6-ft. lode was made on the Booth & Douglas property. The recent discoveries are reported to have attracted the attention of the Standard Oil Co., which is now making an examination of the various deposits. The most extensive cinnabar deposits previously discovered were at the head of Iron valley, near the town of Midas.

Litigation.—The controversy between the Tonopah Mining Co. and the Continental Mining Co. over the ownership of the Buffalo Boy mine is still undecided. The Continental company has been in possession of the property for six years and during that period has spent \$30,000 on development. This work has proved highly successful and resulted in the blocking of a large tonnage of \$19 ore. The property was examined by the Mines Company of America about a year ago and it is stated that the examining engineers placed a value of \$600,000 on it. While the Continental Mining Co. was engaged in developing the property, it was re-located in the name of a certain Mr. Belford and notice was served on the superintendent that he was a trespasser and must vacate the premises at once, which



☾ SUNSHINE AND SNOW IN THE SAN JUAN REGION, COLORADO.

he, of course, refused to do, and is still in possession. While it seems incredible that such a valuable property should be held and developed for six years without a proper title, the evidence would indicate that such is the case. Local feeling is in favour of the Continental company, as it has held and developed the property in apparent good faith, even though its business methods may appear on the surface as puerile.

Oil.—Although affairs in the oil-fields are quiet, as is the general business condition elsewhere on the Pacific Coast, there is nevertheless an air of expectancy manifest among the leaders of the industry. The chief topic of conversation is the probability of the acquisition by the Shell interests of a large area of proved land on the Kern River field. The daily press has printed many rumours of heavy buying by the Shells, and at one time it was said that they had purchased the Associated Oil Co., but this has been denied. There is no room for doubt that the Shells are already greatly interested in the possibilities of California and that they will become more so when they can acquire properties that are up to their requirements. At present they are doing business under the name of the American Gasoline Co. A number of distributing stations for selling gasoline and distillate have been established at strategic points on the Coast, and a vigorous campaign has been instituted for the automobile and motor-truck trade in competition with the Standard Union, and Associated Oil companies. The immediate result has been a rapid drop in the price of gasoline, to the great delight of the motorist. At present the price to consumers is about 14½ c. delivered in tank-wagons in lots of 50 gallons or more, and even lower prices are expected. The new pipe-line of the General Petroleum Co. between the oilfields and Los Angeles is working most satisfactorily. The pumping plants are an innovation. Crank and fly-wheel Corliss-compound condensing engine-driven pumps are used instead of the usual direct-acting type. The governing devices have been arranged with such nicety that in one case the engine was throttled down to only 14 r.p.m. while pumping against a head of 500 lb. per sq. in., which, for a 36-in. stroke engine, is excellent pump-duty. As an instance of the superiority in steam economy of the former over the latter type, a direct-acting pump had been operating in one station and required two 250-h.p. boilers for its operation. When the change to the Corliss, crank, and fly-wheel pump was made, one boiler was shut-down

altogether, and on the remaining boiler only one burner instead of two was required to maintain steam. It should be mentioned that the direct-acting pump displaced was a duplex tandem-compound condensing type. A report is in circulation that the General Petroleum Co. will become a member of the Independent Producers' Agency in order to take advantage of the organization of the latter for marketing heavy grades of oil. Such a move would strengthen the position of the Agency very greatly, and simplify the selling and distributing problem to a marked degree.

Much interest has been manifested in the announcement that the Standard Oil Co. is about to undertake the manufacture of gasoline from casing-head gas. This involves the compression and condensation of natural gas, and produces a high-gravity gasoline suitable for aeroplane motors or for blending with the lower-grade naphthas for use in motor-cars. A plant has been ordered to be erected at the company's wells in the Newhall district and it is expected that other plants will follow. The Union Oil Co. was the first of the large producers to adopt this method of utilizing their natural gas production, and is now erecting a plant that will have a capacity of 8,000,000 cu. ft. natural gas per day from which 8000 gal. gasoline will be produced. Many smaller companies are engaged in producing gasoline by this method, the daily output from the Santa Maria field being from 4500 to 5000 gal. per day, and that of the Fullerton field 4000 gal. per day. The new refinery for the Associated Oil Co., one of the Southern Pacific Co.'s subsidiaries, is nearing completion, and this company to strengthen its position has just purchased the Monarch Refining Co.'s plant at Oakland.

Mexico.—The recall of Ambassador Henry Lane Wilson from Mexico City to attend a diplomatic conference at Washington furnishes new material for thought in the Mexican situation and the American investors in Mexican properties will anxiously await the result of the conference, to be held in the latter part of the month. While this is not the first time that Mr. Wilson has been summoned to Washington regarding Mexican affairs, it is believed that the present visit will result in either a recognition of the Huerta administration or an official statement of the attitude and intentions of the United States Government toward Mexico. That conditions in Mexico are not improving is well known to everyone who has kept in touch with the situation, and it is generally believed that Mexico will be forced to look for outside assistance in the settlement of

her domestic affairs. It is to be noted that the anti-American sentiment, so frequently voiced by the Mexican press in the past, has about died out completely and the better element, having tired of seeing their country laid waste by brigandage and appreciating the inability of the Government to cope with the situation, will welcome almost any solution that will restore peace. The Huerta administration has proved a failure from every standpoint. Although apparently an effort has been made with the facilities available to restore peace, the iron hand of the military has been so stayed by lack of funds and men that it has not been possible to accomplish anything toward the establishment of peace, even though the intentions have been the best. Madero came into power under the most auspicious circumstances and failed; Huerta was looked upon by the mass of the people as being the man of the hour who could unite the dissenting factions and restore peace, but he also has failed; Felix Diaz has incurred the animosity of the whole of the North and is impossible as Huerta's successor. It appears that Mexico is lacking in presidential material and there is no one in sight who can step into the place of Porfirio Diaz.

NEW YORK.

Copper.—After over two months of inactivity the copper market in New York developed sudden activity at the middle of July and within a week over 100,000,000 lb. of the metal changed hands. Quotations had been shrinking steadily, though few sales were made for the past two months, and buying began at $14\frac{1}{2}$ c., the price advancing to $14\frac{1}{2}$ c. Most of the buying was for export, few domestic consumers having come into the market on any large scale before the end of July. Under ordinary circumstances such active buying would have caused a greater advance in prices, but the business outlook in America is still dull. The tariff bill has not yet been passed, nor the currency bill, the summer is normally a dull time, and the moving of the crops in the autumn produces every year a little crisis in business affairs, for the harvesting, sale, and shipping of the crops calls for a tremendous amount of ready cash, compelling other business to give way. Early each summer bankers begin to restrict time-loans in order to increase their liquid reserves. The summer and early autumn therefore is favourable to speculation, for call money is plentiful, but rather dull for general business. There is no speculation in copper in New York,

hence it seems scarcely likely that there will be any marked advance in the price of copper before the autumn at least, unless the Michigan strike should be a protracted one. Statistics for the first half of the year are now available. Production during that period is reported as 809,194,026 lb., and deliveries as 861,692,002 lb., corresponding to a shrinkage in stocks of over 52,000,000 lb. Although European stocks also show a decrease during



Bringing Ore to a mill near Parral, Mexico.

the same period, consumers are evidently of the belief that statistics can be made to prove anything, and have exhibited no anxiety to secure part of the shrinking visible supply. The copper statistics merely give a sort of cross-section through the copper situation, showing the relations existing at that point, namely, the output of the refineries, the deliveries to the trade, and exports. How much blister the smelters have in their yards, how much is in transit, and how much is piled at the refineries is quite another affair, of which no one knows any more than they can know how much electrolytic copper is stored in the

yards and warehouses of consumers. Evidently the metal-users are relying on the fact that they are continually hearing of the development of big new copper properties but never of the shutting-down of any, and have faith to believe that copper will be available to meet their needs, whatever statistics may say.

Chuquicamata.—Last month I gave some details of progress at the new copper mine at Chuquicamata, in Chile. Like all American mines, it makes its debut with a well developed lawsuit attached, though in this case the controversy is over promotion profits instead of the ownership of orebodies. Louis Ross is suing A. C. Burrage in Boston for \$2,500,000, being a 10% interest in the \$25,000,000 worth of Chile Copper Co. stock which Burrage received for his share in the development and organization of the property. Ross claims that Burrage engaged him to do exploratory work and to secure options on the properties for a consideration of \$500 per month, travelling expenses, and 5% of the common stock allotment as promoter's profits. Burrage claims that Ross was to receive 5% of the stock of one of the companies formed, or else \$100,000 in cash, and that the \$100,000 was offered to Ross, who refused to accept it, on May 6. Burrage claims that the Guggenheims refused to have anyone else except himself associated with them in the deal. Daniel Guggenheim and Pope Yeatman have been called upon to testify and the case promises to be as protracted as the Old Dominion suit, which has become almost as much of a Boston institution as the sacred codfish. The Braden, another Guggenheim copper mine in Chile, has so far been making a rather poor showing, as the recovery in the mills has not been good, and progress in equipping the property has been rather slow. The outlook has recently considerably improved, as the mill report for June was the best for any month to date. The two mills treated 61,127 tons of ore, with a 68.2% recovery, producing 1,800,000 lb. of copper. The Hardinge mills, which are to be used to re-grind the tailing before sending it to the Minerals Separation plant, are rapidly being installed and by the end of this summer the management hopes to have each of the two concentrators handling 3000 tons per day. Only about two-thirds of the tonnage now goes to the flotation plant because of lack of re-grinding capacity. When all the tailing is subjected to flotation there should be a further improvement in recovery, 70 to 75% being hoped for. Pope Yeatman,

the consulting engineer, has recently re-calculated the ore reserves as exposed in recent development work, and finds there is 16,660,760 tons of developed ore, averaging 2.65% copper, 8,749,444 tons of probable ore, averaging 2.63% copper, and 18,742,033 tons of possible ore, averaging 2.61% copper. The superintendent, Robert Marsh Jr., ventures the prediction that 60,000,000 tons, containing 2½% copper, will ultimately be developed. Two blast furnaces, 46 by 180 in., are now in operation, and also two Peirce-Smith basic converters. The electric-power station has recently been completed and the leaching experiments which have been held in abeyance because of shortage of electric power will now be started.

Lake Superior.—The threatened strike in the 'copper country,' as the Keeweenaw peninsula of Michigan is often called, has come at last; twenty mines in four counties shut-down on July 22, somewhere between 15,000 and 20,000 men having quit work. The miners are demanding higher wages and shorter hours, but the real issue is the recognition of the Western Federation of Miners, though less than one-quarter of the men affected belong to the Federation. The operators are strongly against recognition of the union, and with copper at 14½ c. are likely to make a vigorous fight. It is to be hoped that they may succeed, for the Federation failed to secure recognition in the Black Hills a couple of years ago and lost its fight in Utah last year. A third defeat would be something like a *coup de grace*. Such an outcome is devoutly to be wished for, for the Western Federation has stood for terrorism and anarchy for twenty years. The rank and file of working miners are decent and law-abiding and if they could rid themselves of the law-breaking coterie which has secured domination in their affairs, they would be much better off. The labour situation in America presents serious economic problems. Recently Congress passed an act exempting labour organizations and farmers' associations from the provisions of the Sherman anti-trust act. This was passed as a result of the insistence of the Federation of Labor, and its action is significant of its attitude toward law and justice. Labor-unions represent a force for the intelligent and fair adjustment of industrial relations, but when they demand immunity from the restrictions governing other industrial organizations, they tread on dangerous ground.

Mexico.—During the last week in July an added fillip was given to the Mexican situation by the shooting of a United States immi-

gration inspector in Juarez and the capture and announced determination to execute Charles J. Biesel, general manager for the Mines Co. of America, and Bernard MacDonald. Mr. Biesel had gone to one of his company's properties and arranged to ship out a considerable amount of silver bullion which had accumulated there. After having arranged to pay the bullion-tax to the Carranza government, which is in control at that point, he was arrested by Huerta government officials on a charge of conspiracy to defraud the Government. The American administration was at last galvanized into activity and made such vigorous representations that even the present

Government troops are pursuing the rebel forces and bandits relentlessly and persistently at all points. In the south, General Robles is conducting a closing-in campaign round the Zapata hordes. At El Oro and Pachuca, there has been no cessation of work, and no interference of any kind.

Mining.—There is a little excitement regarding the smallness of the profit of the Santa Gertrudis. By some it is said that the mine is opening up in depth better than ever; others say that this is not so, while a further rumour goes to the effect that the company has purposely kept down its output owing to political conditions. In any case, the lack of reliable



THE NATIONAL PALACE, IN MEXICO CITY, DURING THE LAST DAYS OF THE MADERO REGIME.

so-called government of Mexico was impelled to respect them. Henry L. Wilson, the ambassador at Mexico City, has been recalled to Washington to report on the situation. His course of action seems to have met with marked disfavour, and there is every evidence that he will not be returned to his post. The relative desirability of intervention and mediation are supposedly being discussed at Washington and there is good prospect of a vigorous and thoughtful policy in regard to Mexican affairs being followed in the future.

MEXICO.

Political.—According to the latest reports, the Huerta government is gradually wearing down the rebels. Monclova, in Coahuila, the headquarters of the Carranzistas, was captured by the Federal troops after severe fighting on July 11, and, according to reports, the

official news is to be deprecated. The La Blanca is going ahead steadily, and its profit last month (June) is said to be over £15,000, which after putting aside sufficient for its ordinary dividends would leave £7000 to go forward. It is stated that the board of directors of the San Rafael company has been changed, and the share in profits formerly pertaining to the directors has been reduced one-half. It is stated that the Natividad Company (Oaxaca) is now nearly out of debt, and the price of the shares remains very firm. Rumour has it that the staff of Goerz & Co. at the La Fé mine has been reduced, owing to uncertainty of obtaining supplies, and if this is true, it will mean that there will be considerable delay in the completion of the new reduction works. Messrs. Denny Bros., for the Selected Mines of Mexico, have started active shaft-sinking operations on the Ohio-Trinidad properties

near the La Blanca mine, and on July 10 the shaft had reached a depth of 47 ft. All arrangements for the erection of a new head-gear have been completed, and a hoist and air-compressor are being installed almost immediately. The results of shaft-sinking on this property are being anticipated with considerable interest locally. The same firm is also engaged in unwatering and valuing the famous old Concepcion de Borda mine in the El Oro district; while the adjoining property, the Borda Antigua, is being valued and opened up by the Dos Estrellas company.

Condition of exchange is very bad, and raises some doubt as to the £14,000,000 still to come on the £20,000,000 loan, and if exchange continues bad, it will give rise to the suspicion that the said £14,000,000 is in jeopardy. There is little doubt that, given the proper financial support and recognition by the United States, the present Government will succeed in pacifying the country within a few months.

CAMBORNE.

Clayworkers' Strike.—I have referred from time to time during the past few months to the restlessness of the clayworkers in the Mid-Cornwall area. This restlessness has at last culminated in a general strike, which has been successfully engineered by the Workers' Union, a body which, in other parts of the country, consists chiefly of general labourers. Although probably not more than one-third of the men were members of the union at the time the strike was declared, they were able by methods, not always peaceful, to persuade the non-unionists to 'down tools,' and today the union is able to declare that all the pits are idle. A strike of this magnitude is a novelty in Cornwall, where the trade-union movement has made little headway. So far as I can judge, had the owners redressed the men's legitimate grievances when appealed to nine months ago, the effort to establish the Workers' Union in the clay district would never have been successful. The masters made the mistake of practically ignoring the claims of the men, claims which most outsiders think were not unreasonable. Now the demand is made (1) for recognition of the union, (2) a minimum wage of 25 shillings per week, and (3) the re-instatement of all the strikers to their old positions. The owners have combined to particularly resist the recognition of the union, and they are firm on this point. As so small a proportion of the men are eligible for strike pay, it is doubtful

whether they will be able to stand firm for long. Hence the owners have so far declined all overtures for arbitration by the Board of Trade, which offered the services of that successful negotiator, Sir George Askwith. I fancy the owners will win on this occasion, but an increase in the wages of these men has got to come sooner or later. It is an industry in which handsome profits have been and are being made, and in view of the increased cost of living, the men are fairly entitled to a wage that will enable them and their families to live in moderate comfort. Even 25s. per week is not outrageously munificent, but it is evident that the men now on strike would accept less. Under the circumstances, their services warrant more than the 20s. to 22s. per week now generally paid.

Wheal Kitty & Penhalls United.—This St. Agnes property, controlled by that veteran enthusiast on all things Cornish, J. H. Collins, made a profit of £532 for the half-year ended June 30 last. The average yield showed a slight increase from 22'16 lb. to 24'5 lb. black tin per ton, but on the other hand, the working cost was up 2s. per ton (being now 27s. 3'8d.), while the average price realized for the company's black tin was down £4. 5s. per ton. The tonnage stamped was 6804 and the yield 74½ tons of black tin. The development footage was down considerably. In this district, a decline in development work is a feature one does not care to see, for the lodes are buncy. It is satisfactory to note that the bottom of the mine has of late considerably improved, and already this improvement has shown itself in increased sales.

Levant.—At this famous mine at St. Just, so well known to the general public because some of its levels are driven under the sea, a profit of £1187 was made for the sixteen weeks ended July 5 last, and although this is a fall as compared with the previous period of £564, the reduction is more than accounted for by the fact that while 16 weeks' expense was charged, only 14 weeks tin production was credited. The average produce was 30 lb. black tin per ton, which is slightly higher than last time. A dividend of 7s. 6d. per share, absorbing £883, was declared, and a sum carried forward of £6669. The meeting of shareholders was chiefly notable for the speech of Francis Oats (of De Beers fame), who is the largest shareholder. The lease of the property expires in a year or two, and the 'lords' appear loth to renew without exacting higher royalties and insisting on a large development scheme. It would appear from Mr. Oats'

speech that another party is offering better terms, but he made it clear that the present company was not prepared to enter into any competition in this matter. The shareholders are willing to take a renewal of the lease on the same terms as the existing one, and to spend a large sum, probably not less than £10,000, on development, but as Mr. Oats pointed out, he is indifferent whether the lease is renewed or not. If they were turned out, the reserve fund would be available for distribution, and also the amount received for the sale of the machinery; while on the other hand he was confident that it would be a long while before the fresh money put into the mine would be regained. The miners of the district must have heard with satisfaction that the present company is prepared to allow any new people to take over the machinery at valuation, and start work, so that when one company ends, the other begins. Another announcement of interest was one indicating that if the lease was renewed, limited liability would be adopted. The present company is the last of any importance working under the cost-book system, and Cornishmen generally will view with regret the disappearance of a system, which, while not suitable for large undertakings with scattered shareholders, has many advantages over limited liability, not the least being the lower administration cost.

Cornish Tin Sands, Ltd.—This company was formed some time since to work the tin sands at the mouth of the Red river, and after investigations had been made, a plant, equal to dealing with 200 tons daily, was ordered. Part of it has since been delivered. It will be operated by electrical power supplied by the Cornish Electric Power Co. The method of treatment will be to pump the sand to the top floor of the treatment shed and then pass it directly over Record tables, from which it will go to grinding pans. The concentrate will be roasted and passed over Frue vanners. It is anticipated that operations on this scale will commence in October next, and in the meantime the small plant of the late owners is being operated.

Dolcoath.—A reduction in the tonnage milled of 2327 tons, a fall in the produce of 2 lb. per ton, a decrease in the sale of black tin of 81 tons, and a lower price of about £3 per ton of concentrate sold, have had the effect of curtailing the proposed dividend for the six months ended June 30 last to 1s. per share against 1s. 6d. for the previous half-year. It is however stated that the long looked-for improvement in the bottom of the mine around

the Williams shaft has at last taken place, and while it is yet early to speak with any confidence, this improvement has already had a marked effect on the price of the shares, which for some time past have been depressed. The half-yearly meeting is shortly to be held, and news of the discovery will then be given.

Geevor Tin Mines.—This St. Just property continues to develop well, and it is officially reported that ore sufficient to supply 100 tons per day for approximately four years has been proved. The new mill has been running for four months, and the production is now 30 tons of black tin per four weeks, which equals a recovery of about 27 lb. per ton of ore milled. If this average is maintained, there should be a fair margin of profit at present prices.

East Cornwall.—It is interesting to note that the South Mount Boppy Co. has undertaken the development of the Carpuan, Bowden, and Bury Down setts, situated at St. Neot, and comprising an area of 360 acres, with a length of nearly one mile on the line of the lode. In the Bury Down sett, four well defined lodes have been proved by means of pits and trenches, and all show traces of tin. On the Bowden sett, a pit has been sunk in a 6-ft. lode which assays 12 lb. black tin per ton, while the leader in the same lode on the Carpuan section of the property gave by vanning 24 lb. per ton over a width of 2 ft. The setts have been examined by Josiah Paull, of South Crofty, whose report was sufficiently favourable to warrant the company spending £2000 on their development.

At Phoenix, near Liskeard, good progress is being made with the main cross-cut south at the 1193-ft. level, which is being driven to intersect the lode under the old mine. Two winzes sunk in the bottom of the old mine have given excellent assay-values.

Unwatering Old Mines.—Matters at Condurrow seem to be at a standstill, and while negotiations are going on for the provision of further capital to drain the mine to the bottom and develop it, the debenture holders are providing the money to keep the pumping engine at work. At Peevor United, the Cornish pump has just commenced work, and the progress of the draining operations will be watched with interest. At Killifreth, good progress is being made with the erection of the pumping and winding plants. The shaft has been cleared and timbered to adit, which has also been cleared. In addition to the Cornish pump, it is proposed to use bailing tanks to drain the mine.

PERSONAL

F. W. ARMSTRONG has gone to Northern Nigeria.

G. PERCY ASHMORE sailed for Newfoundland on August 2 by the *Megantic*.

J. H. BATCHELLER has resigned as metallurgist to the Tomboy Gold Mines company.

H. BERTRAM BATEMAN is in Portuguese East Africa.

J. J. BRISTOL has returned to the Abbontia-koon mine from Reno, Nevada.

WALTER BROADBRIDGE has returned from a visit to the Nevada Consolidated Copper Mines.

A. H. BROMLY has returned after an absence of 10 years in Mexico.

WILLIAM CALDER is the new president of the South African Institute of Engineers.

DONALD F. CAMPBELL was at Liège a week ago.

J. PARKE CHANNING has been at Butte, Montana.

C. W. CHATER has returned to England from Northern Nigeria.

H. O. CRIGHTON has terminated his agreement with the Nigerian Tin Corporation, and is now in England.

GEORGE E. FARISH has left British Columbia, and is now at New York.

ROWLAND C. FEILDING has joined the board of the Olekma & Vitim (Lena) Gold Syndicate.

J. H. FENNELL has returned from Northern Nigeria.

DONALD F. FOSTER has left London on his return to West Africa.

R. M. GEPPERT is examining copper deposits in Greenland.

ANDRE P. GRIFFITHS has been appointed general manager of the Dos Estrellas mine, at El Oro, Mexico.

E. M. HAMILTON has gone to Salvador for the Butters Salvador Mines.

H. W. HARDINGE has been at St. Petersburg.

J. A. LEO HENDERSON has taken offices at Worcester House, Walbrook, E.C.

C. S. HERZIG sailed for New York on July 23, on his way to Oklahoma.

H. LANCASTER HOBBS has gone to Portugal on behalf of Bruce Marriott & Co.

S. RAMPLEN JONES is home from Perak, in the Malay States.

H. I. KEEN is at Chicago.

W. J. LORING has returned from Burma and Australia.

FRANCIS CHURCH LINCOLN has been appointed resident engineer for the Bolivian Development and Exploitation Company, with headquarters at La Paz.

A. C. LUDLUM returned to New York on the *Imperator*.

J. W. NEWBERY has returned from the Gold Coast.

HORACE G. NICHOLS has sailed for New York on his way to Idaho.

R. G. PEARSON, lately at Ipoh, Malay States, is now at Naraguta, Nigeria.

W. PELLEW-HARVEY has returned from the Great Cobar mine, New South Wales.

WALTER G. PERKINS is now consulting metallurgist to the Spassky Copper Mine, Ltd.

F. DANVERS POWER is coming from Sydney to London by way of Borneo, Hong Kong, and Japan.

GERALD PUDSEY is manager of the Mill Close lead mines, Derbyshire.

STUART L. RAWLINGS is in London from San Francisco.

J. H. RICH is general manager of the Tronoh, in the Malay States, in succession to Harry D. Griffiths, resigned.

H. M. RIDGE has returned from a professional visit to Croatia.

ALEXANDER RICHARDSON has been elected president of the Chemical, Metallurgical, & Mining Society of South Africa.

REGINALD W. ROBINSON is home from the Rand.

F. PERCY ROLFE has left the Consolidated Langlaagte, and is now manager for the Peach Tree Syndicate at Pilgrim's Rest.

JOHN SHIELDS is here from Rio Tinto.

K. M. SIMPSON, from Reno, Nevada, was in London recently.

J. B. TYRRELL was recently in northern Quebec.

E. J. VALLENTINE is returning from the Malay States on a holiday.

ERNEST WILLIAMS has spent several weeks at St. Petersburg.

H. C. WILMOT has resigned as superintendent for the Colorado Mining Co., in the Philippine Islands, and is now manager for the Syndicate Mining Co., on an adjoining property.

HERBERT C. WOOLMER, general manager of the Spassky Copper Mine, will hereafter make his headquarters at Moscow.

GEORGE J. YOUNG has been appointed professor of mining and metallurgy in the University of Minnesota.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Specialists.

The Editor:

Sir—Two letters in your June issue suggest criticism from a similar point of view. Mr. A. W. Allen protests against the mining engineer assuming to advise as to metallurgical questions, for the solution of which he is not qualified by experience and training. Mr. F. E. B. Fripp considers that the "administrative engineer," a term apparently intended to be synonymous with "mine manager," necessarily tends to "lose the faculty for forecasting uncertainties, and for giving a true proportion to the possibilities, or lack of them, in any given deposit," and should therefore confine himself to turning 'ore-in-sight' (whatever that may be) "into the best marketable form, at the least cost."

Both of your correspondents write from the standpoint of the specialist. They leave a rather depressingly confined field for the energies of the general practitioner.

Granting fully the pre-eminence of, and necessity for, the specialist, when it comes to the detailed planning of his special work, is it not the fact that the very concentration of interest and experience which create his value tend to make him take a dangerously narrow view? In considering at the outset the treatment of a given ore, for instance, is not the mining engineer of broad training just as likely to start on the right track as the metallurgist, who may be a specialist in just the wrong field? Is the general practitioner likely to lead his clients further astray than the cyanide specialist who happens to be called upon to advise on the treatment of an ore which ultimately proves to be suited only for smelting, or *vice versa*? I submit as the answer that the general practitioner, if he is honest and knows his business, will call in the specialist indicated as particularly qualified to solve the problem. But somebody has to select the specialist: which involves the choice of the direction in which the investigation is to start. The all-round mining engineer is likely, all things considered, to be the safest guide at this stage.

As to Mr. Fripp's contention, there are doubtless some mines in which the manager's business is merely to turn 'ore-in-sight' into

money. But a mine manager who lacked the faculty for forecasting uncertainties, or seeing the possibilities or absence of them, in his mine, would surely lack the most essential part of his equipment. Personally, I think that no engineer without experience as a manager can ever be entirely qualified to examine mines (although I admit there are some striking cases which appear to indicate the contrary), for the reason that he must find it more difficult to appreciate the commercial conditions on which the value of any deposit depends. On the other hand, an engineer whose work is confined to managing mines, without the broadening and stimulating effect of examination work in connection with mines in other districts, is very apt to become 'hide-bound.'

I believe the only general rule which we can apply to these cases is a very old and simple one: that no man should undertake to give advice unless he feels qualified to give it. The matter is one of ethics rather than of drawing a line between different branches of the profession.

A somewhat similar point is suggested by Mr. Gelasio Caetani's article in the same number. Mr. Caetani says: "A consulting engineer, if asked to examine a mining property that he knows to be worthless, ought to notify his prospective clients that the mine does not warrant the expense of the examination, even if in so doing he may lose a job."

Surely this is self-evident. I think we all accept Mr. Caetani's principle, and I hope we shall all have the courage to live up to it. But when he goes on to say that "It does not pay to be associated with enterprises that fail, the reputation of an engineer does not depend on his ability to do a good piece of work: it depends also on the success of the enterprise with which he has been connected," he does not carry entire conviction to my mind. Few engineers are in a position to choose their engagements; and ultimate success often, perhaps usually, depends on conditions which the engineer cannot make or unmake, or in some cases even foresee. I am tempted to reply to Mr. Caetani by quoting another old maxim: that the man who never makes a failure is never likely to make anything else.

In any event, Mr. Caetani's observation can

apply only to the engineer primarily responsible. For myself, I believe that the man who undertakes to make the best of a difficult enterprise which he did not originate, and who accomplishes sound work, even although the margin of profit may not justify its original inception, and although the ultimate success achieved, expressed in figures, may be incomplete, has done honour to his profession. It may be that the outside public will always be slow to recognize merit "associated with enterprises that fail;" all the more, it is incumbent on his professional compeers, who know better, to judge more fairly.

A little further on, Mr. Caetani raises a point that bears on the same question of specialization to which I have previously referred. He speaks of the difficulty of obtaining representative samples of ore for testing from a mine, and goes on to say: "A metallurgical engineer, therefore, ought to make it a special point to superintend the breaking of the sample that will be used for testing." This I very much question. I agree with all that Mr. Caetani says as to the difficulty, in many cases, of obtaining a sample for testing that correctly represents the average of the ore to be yielded by the mine. But unless the metallurgist takes on himself the entire function of the mining engineer, and gives the mine the same comprehensive study as the latter should (which I do not understand Mr. Caetani to advocate), it may be impossible to arrive at a fair sample. The latter depends on correct proportioning of tonnage from each ore-exposure of the mine; on the methods of mining, which will influence the physical condition and (owing to admixture with waste, etc.) the value of the ore; and even on such matters of judgment as the ultimate possibilities of the mine, in relation to its chances of producing varying quantities of ore of different types. No metallurgist, as such, can be qualified to do this. Surely it is far better for him to accept the samples furnished to him, and state clearly in his report that his recommendations apply to ore represented by specific samples.

Going further, I incline to think Mr. Caetani's contention merely supports my own idea that we have here again a case where, in the main, the judgment of the general practitioner must and should prevail, because he alone is qualified to know and judge the primary facts. The subsequent work of the specialist in designing and laying out the mill that is to embody the scheme of treatment selected is of extreme importance, but it must

be controlled and directed by that of the all-round engineer, who alone should be held responsible.

GEORGE E. COLLINS.

Denver, July 18.

[The article on 'Mine Managers as Valuers' appearing on another page, discusses the same problem.—EDITOR].

Royal School of Mines.

The Editor:

Sir—Your generous offer to devote a page in each issue of *The Mining Magazine* to the affairs of the R.S.M. will be most highly appreciated by all School of Mines men.

Anyone who has studied the final report, recently issued, of the Royal Commission appointed to inquire into University Education in London, cannot but be struck with the insignificant position the R.S.M. will have to take in the University if this report is adopted, which points to the fact that the Commissioners did not sufficiently realize or consider the enormous value and importance of the industry connected with mining and metallurgy.

The position today is that the R.S.M. is in a perilous position and nothing but the combined efforts of all old students can prevent its obliteration. In this, I am sure, the Institution of Mining and Metallurgy, which amongst its members contains a large sprinkling of R.S.M. men, will lend a helping hand, as it did a few years ago, when, although the position was not then as serious as it is now, it was the means of the School retaining its identity.

It does seem remarkable, almost incredible, that England, together with the Empire, with its enormous and valuable mining and metallurgical industries, should have any doubt as to possessing and maintaining a School of Mines, independent of any University. Other countries, as will be seen below, with far less mineral production, support and are proud of their mining schools. I almost fear that perhaps in those countries there may have been a stronger and more determined *esprit de corps* existing among the old students, which exercised an influence on the Authorities, than has been the case with ourselves.

Taking the annual value of the mineral production of the United Kingdom at 100, that of the following countries is approximately as follows:

Germany 90, Spain 50, France 25, Sweden 4.

Surely this ought to be sufficient to put us to shame and to convince us of the advisability, nay necessity, of having a School of

Mines in London. On the other hand, if the R.S.M. is to become a part of the University, as suggested in the final report, this old and world-honoured institution will become as an attic in a ten-story building.

Considering the value of the mining industry in the various colonies constituting the Empire and the importance of the mining schools maintained by these colonies, and with the view to consolidating the schools with the parent one in London, I would like to suggest that a graduate of any recognized School of Mines in the colonies, can, by taking the mining or metallurgical course at the R.S.M., become an A.R.S.M.; and *vice versa*, an A.R.S.M. can similarly become a graduate of any of the recognized schools in the colonies. The R.S.M. should also grant equal privileges to the graduates of the principal mining schools in the United Kingdom. By this means the various mining schools of the Empire would become associated with the R.S.M. and the graduates and associates would form a representative and influential body of mining and metallurgical men.

In the meantime, I strongly urge the R.S.M. Association to take all possible steps to prevent the adoption of the report now before the Government, and to agitate for the appointment of another Royal Commission, composed mostly of mining and business men, to further consider and report on this most important and vital question.

England must have a Royal School of Mines.

FRANK MERRICKS.

London, July 31.

Exit Jemaa !

The Editor :

Sir—Mr. Rumbold's comment, appearing in the July issue of *The Mining Magazine*, on my letter in your April issue, calls for brief reply.

In my letter I did not suggest that two hours was ample time in which to examine a concession of 70 square miles, and I cannot for a moment think that Mr. Rumbold is so dull of comprehension as to have read that meaning into my words. I maintained then, and maintain now, that several of the engineers who visited the outcrop of the so-called Jemaa lode were able in a comparatively short time to arrive at a correct opinion as to its merits. That opinion was that the extravagant statements of the Anglo-Continental management regarding the possibilities of this outcrop were highly preposterous, and further that the area on which the development work

was being done had little, if any, prospective value. The rest of the 70 square miles controlled by the company might have been 700, or any other figure. Neither at that time, nor since then, has any value been attached to the property outside of the extremely narrow limits within which prospecting operations were being carried on.

C. S. HERZIG.

London, July 22.

[This discussion is closed.—EDITOR].

Rhodesian Gold Output.

The Editor :

Sir—In your leader in June issue of your magazine under the heading of 'Rhodesia' I note the following :

"The output of gold for April was reported as being worth £241,098, so that the record of £257,797 during March has not been maintained. The decrease appears to be chiefly due to the shorter month's work at the leading mines."

This portion of your paragraph cannot be but misleading. The record month of March included a large quantity of reserve gold declared by the Globe & Phoenix, the actual month's working being not so good as April. The figures are as follow :

Output for March	61,274'36 oz.,	£257,797.
Less reserve gold		
declared	... 4,764'04 ,,	20,009.

Actual month's

working	... 56,510'32 "	£237,788.
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This in itself is a good month's work, but April was even better :

	57,295'38 oz.,	£241,098,
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being an increase of 785 oz., valued at £4310, as compared with the actual month's work in March.

The figures for May go one better, being an increase of 570 oz., valued at £2,354, as compared with the April output.

To the casual reader of your remarks it would appear that Rhodesia is not doing so well as she ought, whereas the above figures abundantly prove that she is going ahead. The total output for 1912 was a record, but the output to date for 1913 shows an increase over the same period of 1912 of 18,323'80 oz., valued at £76,219. With the Kimberley Reefs coming into the list of producers it seems as if the production for the remaining months of 1913 will show an even larger increase than did the first five.

A. NOEL.

Bulawayo, July 10.

Coaching.

The Editor :

Sir—As a former member of the junior staff of the Royal School of Mines for the last eleven years, and, moreover, one who has had some slight experience of coaching, I trust you will permit me to criticize the paragraph on this subject which appeared in your last issue. In the first place, I entirely disagree with the statement that "A good deal of feeling has been created at South Kensington, &c.," and, further, as I strongly object to the practice of judgment without defence, I trust you will, in common fairness to myself, find room to insert this letter.

Coaching has been in vogue at the R.S.M., to my certain knowledge, for the last 14 years, and, although, perhaps, rather more prevalent than it was, say, 10 years ago, has always been looked upon with tolerance by the professors. Let us consider the various classes of students who coach, and why they coach, before we condemn this practice undefended. Firstly, we have men who coach for the express purpose of obtaining first-classes, and these men form the bulk of the 'coaches,' at any rate in the third and fourth years. To obtain this coveted distinction, a *minimum* of 80% of the marks obtainable must be gained by the student. Now it must be obvious, even to the biassed and prejudiced, that the standard is a very high one, and I believe I am correct in stating that 50% would qualify for a first-class at most university 'exams.' At least 90% of the men entering the R.S.M. come straight from public schools, and, as surveying, geology, assaying, metallurgy, ore-dressing, &c., are not usually included in the curriculum of such institutions, the student is brought face to face with totally new subjects. What wonder, then, especially if he is 'keen' that he seeks the aid of his demonstrator to help him after college hours, to explain his difficulties and answer his many questions, bearing in mind, also, that, to get even a second class, 60% of the marks are necessary. The remedy is, obviously, either to lower the standard or abolish the class distinction. Secondly, we have what I may term the 'thick-headed' student, unfortunately by no means a negligible quantity at the R.S.M. There are many instances among this class who have not been placed near the top, but rather at the other end of the examination list, and yet have done exceedingly well in after life and brought credit on the old school. Such men are practically helpless at 'exams,' but when common sense and 'grit' are required are in every way the

equal of men placed far above them on the lists. Are they to be deprived of a legitimate means to the A.R.S.M.? The third class of student who coaches (and he is very much in the minority) is the lazy man. He finds it easier to get someone to spoon-feed him with pre-digested information than to seek it himself. His case need not be seriously considered.

Now there is another side to the question, on which I have not yet touched (and which incidentally introduces the fourth type of student). I refer to the entrance examination. While the standard is at its present low level incapable students will continue to gain admission to the R.S.M. What chance have such students of obtaining 60%, not to mention the standard of first-class, unaided? Comment is unnecessary.

Lastly, we have the foreign students, a gradually increasing factor, men in some cases whose English, even, is of the most meagre description. How can such students be expected and pass the examinations without coaching? And teachers are accused of incapacity when students are incapable of even taking decent lecture-notes.

No, Sir, coaching is an institution at South Kensington as much as it is at Oxford or Cambridge, and the sooner this is realized *in the City* the better. If students are deprived of coaching from internal sources, it will be obtained from outside, or the standard of the A.R.S.M. must be lowered.

With regard to the veiled insinuation in the last portion of the paragraph "Coaching.....
.....undermine that sense of honour.....
....." This I will dismiss as being unworthy of the writer and beneath the notice of the junior members of the staff for whom it was presumably intended.

There are two further points I could touch upon at some length, namely, the remuneration of demonstrators, at present at a disgracefully low level, and the increasing number of subjects to be taken by students, but I will not encroach further on your valuable space.

E. A. WRIGHT.

London, August 1.

[We publish this letter in fairness. The offending paragraph, for which no apology whatever is made, was written after we had discussed the matter with persons not "biassed and prejudiced," but well informed and as anxious to do right as our correspondent himself. Certainly it is to the coaching "from internal sources" that we object, because the

"internal sources" can affect the student's success at examinations in other ways besides teaching him his subject. As we said before, if a student is too stupid, it is well for him to keep away from a mining or metallurgical career; if the teachers are inefficient, then better ones should be engaged and more of them. We quite believe that the junior staff is both inefficient and under-paid, and that is why coaching flourishes to a deleterious degree. A remedy for some of the evils inherent in "coaching from internal sources" is supplementary tutoring "obtained from outside." That obviates many of the objections, but not all. Coaching should be unnecessary if the professors and demonstrators are sufficient in ability and number for the work of teaching the students in the Royal School of Mines.—EDITOR.]

Meticulous Precision.

The Editor :

Sir—Allow me to dissent from you in regard to your remarks on giving exact figures for ore reserves and assays. You object to it on the ground that nobody can accurately work to such precise figures—which is obvious—and then you go on to suggest the substitution of other figures which may or may not be less accurate. They are, at any rate, not those obtained by the man who did the work, but which please you apparently on account of the fact that if shareholders are going to deceive themselves into thinking that such figures are more than a conscientious attempt to estimate, they had better be misled by a round figure.

Is it not a better method for the surveyor to measure up his ore reserves—which may necessitate hundreds of calculations—and give his actual results as he finds them? Similarly the assayer on averaging the results of his assays obtains a figure which runs into two or three places of decimals, and while not pretending that it is absolutely accurate he gives it as the figure actually obtained. Surely it is a mistake to suggest that these figures should be altered to suit shareholders of weak intellect, for any average person who invests in a gold mine should have some knowledge as to what a pennyweight is, and must then know that the ore reserves of a mine cannot be accurately estimated to the fourth place of decimals of a pennyweight. Where should the alteration of the figures end? If it is right to knock off 2616 tons why not add 2000 tons? If the secretary of a company should have authority to alter the figures, why not the promoter of a company also? in which case the addition of a cypher or

two in the end of the ore reserves might help the flotation! Let us have the figures as the men responsible give them and educate the shareholders to know what the value of these figures is.

ALFRED K. BURN.

London, July 23.

[We are always pleased to publish views contrary to our own, in order to elicit such discussion as will clarify ideas. Our correspondent misunderstands. We do *not* suggest "the substitution of *other* figures." If a man by taking the mean of a hundred assays obtains 6'138 dwt. as his result, which is an average of a number of samples every one of which is only an approximate representative of three or four hundred tons of ore, then we insist that he should give 6 dwt. as his figure, not substituting "other figures" but merely omitting the decimals that have no meaning, in that they are the accidental result of a sum in arithmetic, not the expression of an accuracy commensurate with such precision of statement. Certainly, let the surveyor give the figures obtained by him as a surveyor, but a mining engineer, who is more than a surveyor, knows that the variations in the width of ore within a large block of ground, only the faces of which have been seen and measured by the surveyor, are likely to exceed the fractional portion of his final figure. If the surveyor's average width is given at 4 ft. $3\frac{3}{4}$ in., it is well for the engineer to state it in round figures, as 4 feet, because the actual width, as ascertained by subsequent stoping, may range between $3\frac{1}{2}$ and $4\frac{1}{2}$ feet. Moreover, the occurrence of geodes or vughs, the inclusion of country-rock, the breaking of the encasing walls, and so forth, all introduce factors so disturbing as to render silly any refinement of measurement. As a matter of experience we can say to our correspondent that as a rule the ore when milled will assay a little less and the width of it as broken will average a little more than is usually recorded in the report on a mine. The idea is not to "alter the figures to suit shareholders of weak intellect," but to make statements reflecting actualities rather than an imaginary accuracy misleading not only to unintelligent shareholders but to the engineers who indulge in make-believe. "Where should the alteration of figures end?" Where it becomes a mis-statement. When an estimate of 652,616 tons is given for a mine at Kalgoorlie, it is obvious, to those who have had experience in that particular district, that no such accuracy of measurement or estimation is possible as is suggested by the extreme precision of the

figures 652,616 tons. "Why not add 2000 tons, if it is proper to knock off 2616 tons?" Because the round figure (650,000 tons) expresses the facts more closely than 654,616 tons or 654,000 tons. It is not possible to estimate the series of orebodies in the Great Boulder mine within 1000 or even 2000 tons. The round figure is an expression of approximation, which is the only kind of estimate possible under the conditions obtaining in this case. Science is organized common sense. Of course, the suggestion that the secretary or the promoter may change the figures is beside the mark. Such corrections, to express the truth more closely, should be made by the mining engineer responsible, and by no one else.—EDITOR.]

Russian Mongolia.

The Editor :

Sir—I have been somewhat surprised by the absence in the press of comment on the new Russo-Mongolian treaty, the text of which has been published for several months by the Foreign Office and the provisions of which have a distinctly retarding effect on the mineral development of that rich territory bordering on the Russian Trans-Baikal and the southern Altai.

The formation of the new state of Northern Mongolia (Khalki), with its capital at Urga, was the recent result of Mongolian separation from China under Russian auspices. The price that Mongolia has paid for its protection appears to anyone but a Russian to be exceptionally heavy.

The first article of the treaty reads as follows: "The Imperial Russian Government shall assist Mongolia to maintain the autonomous regime which she has established, as also the right to have her national army and to admit neither the presence of Chinese troops on her territory nor the *colonization of her land by the Chinese.*" Thus, Russia, not content with her recent rigid enactments, driving the Chinese out of that immense eastern territory taken from them only 60 years ago, now insists on driving them out of their own protectorate, Mongolia!

There are only four articles in the treaty, but the terms of the annexed protocol, which bears the same signatures as the treaty, are drastic and far-reaching in the extreme, and the fourth article of the treaty provides that Mongolia shall not conclude any treaty with any other power that infringes or modifies any clause in the Russian agreement or protocol without the consent of the Russian Government.

There are 17 clauses in the protocol, which give almost unlimited mining, commercial, industrial, and other rights to Russians in Mongolia, but practically none to Mongolians in Russia. For Russia may appoint consuls and agents wherever she deems necessary in Mongolia, while all contracts respecting real estate and all disputes regarding land must receive the confirmation of, and must be settled before, a Russian consul as well as before a Mongolian authority.

It may now be said to be absolutely necessary for foreigners to obtain the approval of the Russian diplomatic and consular representatives on the spot before acquiring or working mineral concessions or mines in that attractive country. Russian dominance in Manchuria before 1903 presented a similar condition to the present and would but for the Japanese war (due to our supineness in dealing with the Chinese question at that time) have undoubtedly led to the acquisition of that rich country by Russia. It now only remains to be seen how far the borders of the Russian Empire will be extended south and east, and to what extent harried China will be pressed from this new and more vulnerable point of attack.

The Bear should be comparatively safe from foreign intervention here, especially from interference by England—his ancient ally!

D'ARCY WEATHERBE.

London, August 6.

Benue.

The Editor :

Sir—I notice in the July number of *The Mining Magazine* you refer adversely to the future dredging prospects of the Benue (Northern Nigeria) Tin Mines, Limited. As this is the second time you have criticized this company, and as, in each case, you have no doubt unintentionally done so most unfairly, I feel it is only right to point out some of the inaccuracies.

In criticizing Mr. Wontner Brown's report some months ago, your correspondent was guilty of the unpardonable offence of only partially quoting the sentence under review. Mr. Wontner Brown's report reads as follows: "It would be ideal dredging ground were it not for layers of clay in places." Your correspondent took this paragraph, put it in parenthesis, but stopped at the word 'clay,' thus altering entirely the meaning of the paragraph and creating an opportunity for deducing a false inference.

In the present instance you talk about "the

roughness of bedrock, and the sporadic distribution of rich gravel." According to the advice we receive from our engineers, this is directly contrary to report. The attractiveness of Benue as a dredging proposition arises from the fact that the bedrock consists of soft decomposed granite, and the tin, instead of being in rich pockets, is fairly evenly distributed. I would further point out to you that the whole of the dredging area has been very thoroughly and systematically prospected, and again that, in order to verify these tests, and the nature

[We quoted Mr. Wontner Brown as saying that the Bawa area would be ideal for dredging "were it not for the layers of stiff clay." In the presence of layers of stiff clay, no ground can be ideal for dredging. The "correspondent" who made the comment was, of course, the Editor. No "correspondent" ever writes a line of editorial matter in this Magazine. As to the other remarks to which objection is taken, they are based on information from a reliable engineer in Nigeria. He may be in error; if he proves to be wrong, we



TIN-CARRIERS CROSSING THE IGBERRI RIVER.

of the bedrock, a large paddock was opened up from which over 10,000 cubic yards of ground was excavated, passed through sluices, and the tin ore actually recovered.

If I may be allowed to make a suggestion, our consulting engineer will at any time be very pleased to supply you with such information as is available, and in justice to your journal, as well as to the company, it will surely be better to communicate with him before entering upon a criticism based on inaccurate and misleading information.

CHARLES E. PEARSON,
Chairman,

The Benue (Northern Nigeria)
Tin Mines, Limited.

Felixstowe, July 19.

shall not hesitate to express regret. We have tried to see Mr. Reginald Pawle, of Pawle and Brelich, the engineers to the Benue company, but he is out of town.—EDITOR.]

The Sulphuric Acid production in the United States during 1912 was as follows: 50° B. 1,047,483 short tons, 60° B. 451,172 tons, 66° B. 774,772 tons, and other grades 66,166 tons. The total production was valued at \$18,338,109. Of this production, the following amounts were produced by copper and zinc smelters, the figures being reduced to 60° B. acid: Copper smelters 321,156 tons valued at \$1,985,704, zinc smelters 295,917 tons valued at \$2,255,237, total 614,073 tons valued at \$4,240,941.

A Type of Duplicate Loose-Leaf Note-Book for Engineers.

IN alluvial and other examinations it has been the practice among some engineers to equip their assistants with duplicate loose-leaf note-books of pocket size so that drill returns, shaft records, and other tabulated notes may be interchangeable, thus saving the time otherwise occupied in copying, and mistakes due to verbal explanations. Chiefs of parties may visit the various works with the original notes of their assistants safely preserved in their own pocket-books. These notes when necessary can be returned to the assistants later.

hand, replaceable by others when on different work.

The best method of preserving notes from these books for future reference is effected by the use of strong linen envelopes about 5 by 8 inches, which can be endorsed and filed much more easily and conveniently than by the more cumbersome cases supplied by the makers of these books.

Printed forms, on leaves of the same size, with eyelet holes, can be issued to assistants, drill men, etc., for periodical returns.

As an example I give a hand-drill form which I have compiled and found successful during the past few years. This form is reproduced herewith in the exact size used. The dotted line represents the actual size of the page.

PART OF REVERSE PAGE.

DRILL RECORD

Property.....									
Details.....									
Line No.....					Hole No.....				
Water Level.....ft.					Weight of Gold.....mg.				
Depth of Bedrock.....yds.					Value of Gold.....cents.				
Dredging Depth.....yds.					Cu. ft. in test.....				
Value per cu. yd.....cents.									
DRILLING.			PULLING.			LOST TIME.			Remarks.
Date	From.	To.	Date	From	To.	Date	From	To	
	h. m.	h. m.		h. m.	h. m.		h. m.	h. m.	
			MOVING.						
			Date.	From	To.				
				h. m.	h. m.				
TIME.			h.	m.	Time Moving.			h.	m.
Drilling.....					Depth of hole.....				
Pulling.....					Feet drilled per hr.....				
Lost.....									
Total.					Moved to.....				
Remarks:.....									
.....									
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QUOTATIONS

of leading mining shares on the London Market.
Shares are £1 par value except where otherwise noted.
Quotations are given in shillings.

GOLD, SILVER, DIAMONDS.	Aug. 1 1912	July 1 1913	Aug. 1 1913
RAND :			
Bantjes.....	22	20	16
Brakpan.....	77	66	66
Central Mining (£12).....	205	182	180
Cinderella.....	22	8	7
City & Suburban (£4).....	52	50	42
Consolidated Gold Fields.....	77	47	46
Consolidated Langlaagte.....	24	26	25
Consolidated Main Reef.....	20	17	17
Crown Mines (10s.).....	136	136	133
Durban Roodoport.....	20	20	16
D. Roodoport Deep.....	25	22	20
East Rand.....	62	50	47
Ferreira Deep.....	67	60	57
Geduld.....	23	20	20
Geldenhuis Deep.....	32	30	30
Heriot.....	80	60	57
Jupiter.....	10	9	6
Kleinfontein.....	28	21	18
Knight Central.....	8	9	8
Knight's Deep.....	45	45	40
Langlaagte Estate.....	25	23	22
Main Reef West.....	26	10	10
Meyer & Charlton.....	90	100	102
Modderfontein B.....	60	76	77
Modderfontein, New (£4).....	230	247	237
Nourse.....	35	31	30
Primrose.....	41	33	33
Rand Mines (5s.).....	132	126	126
Robinson (£5).....	95	60	60
Robinson Deep.....	47	33	33
Randfontein.....	22	27	27
Rose Deep.....	68	60	57
Simmer & Jack.....	22	12	12
Simmer Deep.....	2	3	2
Sprinas.....	16	15	16
Van Ryn.....	71	73	66
Van Ryn Deep.....	17	30	30
Witwatersrand (Knight's).....	58	72	67
Witwatersrand Deep.....	51	57	53
Wolhuter.....	21	14	14
RHODESIA :			
Cam & Motor.....	31	30	27
Chartered.....	27	19	18
Eldorado.....	35	17	13
Enterprise.....	17	9	9
Falcon.....	26	15	15
Giant.....	37	10	10
Globe & Phoenix (5s.).....	32	27	27
Lonely Reef.....	62	50	49
Shamva.....	60	46	38
Wanderer (5s.).....	2	2	2
OTHERS IN SOUTH AFRICA :			
De Beers (£2 10s.).....	392	430	413
Glynn's Lydenburg.....	26	16	15
Jagersfontein.....	121	130	130
Premier Diamond (2s. 6d.).....	212	250	231
Transvaal Gold.....	46	52	52
WEST AFRICA :			
Abontakoon (10s.).....	7	6	6
Abosso.....	21	17	15
Achanti (4s.).....	20	16	19
Broomassie (10s.).....	4	7	6
Prentiss Block A.....	18	12	13
Taquaah.....	17	16	15
WEST AUSTRALIA :			
Associated Gold Mines.....	7	7	7
Associated Northern Blocks.....	8	19	17
Hullfinch.....	11	15	15
Golden Horse Share (2s.).....	48	53	53
Great Boulder Proprietary Co. Ltd.....	10	12	11
Great Boulder Perseverance.....	2	2	2
Great Frail.....	11	8	8
Leinster (4s.).....	72	57	57
Kaapara.....	45	40	37
Sons of Gwalia.....	20	19	20
Yuanm.....	10	8	8

OTHERS IN AUSTRALASIA

	Aug. 1 1912	July 1 1913	Aug. 1 1913
Mount Boppy.....	30	12	15
Mount Morgan.....	60	66	70
Talisman.....	40	35	40
Tasmania Gold (10s.).....	2	1	1
Waihi.....	32	40	45
Waihi Grand Junction.....	22	20	22

AMERICA :

Alaska Treadwell (£5).....	165	155	160
Buena Tierra.....	15	17	17
Butters Salvador.....	40	47	40
Camp Bird.....	27	14	15
El Oro.....	15	15	14
Esperanza.....	30	17	21
Granville.....	14	11	11
Mexico Mines of El Oro.....	140	110	105
Oroville Dredging.....	5	5	5
St. John del Rey.....	17	15	16
Santa Gertrudis.....	30	20	16
Stratton's Independence (2s. 6d.).....	2	2	2
Tomboy.....	26	26	26

RUSSIA :

Lena Goldfields.....	77	57	52
Orsk Priority.....	20	15	15
Siberian Proprietary.....	15	5	3

INDIA :

Champion Reef (2s. 6d.).....	12	10	10
Mysore (10s.).....	116	107	102
Nundydroog (10s.).....	34	24	25
Ooregum (10s.).....	17	18	19

COPPER :

Anaconda (£5).....	168	135	146
Arizona (5s.).....	41	38	38
Cape Copper (£2).....	147	115	110
Chillagoe (10s.).....	4	1	1
Great Cobar (£5).....	85	38	48
Great Fitzroy (5s.).....	3	1	1
Hampden Cloncurry.....	42	40	42
Kyshim.....	65	60	58
Messina (5s.).....	20	29	27
Mount Elliott (£5).....	112	95	100
Mount Lyell.....	27	23	24
Rio Tinto (£5).....	1587	1440	1497
South American Copper (2s.).....	33	33	34
Spassky.....	80	65	66
Tanganyika.....	53	40	46
Tharsis (£2).....	130	135	140
Whim Well.....	26	15	13

LEAD-ZINC :

BROKEN HILL :

Amalgamated Zinc.....	35	29	31
British Broken Hill.....	50	38	39
Broken Hill Proprietary (8s.).....	54	35	35
Broken Hill Block 10 (£10).....	45	27	28
Broken Hill Block 14 (25s.).....	10	6	6
Broken Hill North.....	132*	45	48
Broken Hill South.....	163	157	152
Sulphide Corporation (15s.).....	25	27	25
Zinc Corporation (10s.).....	14	17	17

TIN :

NIGERIA :

Abu (5s.).....	—	—	14
Bisichi.....	22	20	20
Jos (5s.).....	6	7	7
Kaduna (5s.).....	15	20	20
Naraguta.....	32	36	34
Nigerian Tin.....	30	28	23
N. Nigeria Bauchi.....	7	5	4
Rayfield.....	24	24	20
Ropp.....	47	147	137

OTHER COUNTRIES :

Aramayo Francke.....	28	34	32
Biscuits.....	8	8	8
Cornwall Tailings.....	37	25	22
Dalecoath.....	23	17	17
Geavor (10s.).....	8	17	16
Gopeng.....	78*	32	31
Mawchi.....	28	20	18
Rosoberg.....	32	35	32
Tekka.....	67	60	60
Tronoh.....	72	67	57

* Capital re-arranged during year.

ECONOMICS OF MILLING

By GELASIO CAETANI.

Realities of ore reduction. The dominant purpose. Economic efficiency.
Market factors. Smelter charges. Mixing ores and mill-products.

TO the lay mind it often appears that the main object of ore-dressing is to recover the largest possible percentage of valuable minerals in the form of a few merchantable products. If this were the case the percentage of recovery would be a sure index of the efficiency of a metallurgical plant.

In reality this is not the case. There are two kinds of recoveries to be considered in any metallurgical plant: one is the metallurgical recovery, that is, the percentage of mineral saved; and the other is the economic recovery, that is, the percentage of the gross value of merchantable metals recovered as net profit.

Of these two recoveries, the metallurgical one has but little importance in practice; at best, it is nothing more than a useful indicator of the mechanical efficiency of the plant, as the only information it conveys is that regarding the percentage of minerals saved in the concentrate and of the percentage lost in the tailing.

The economic recovery, on the other hand, is of paramount importance. It is the sole object of the whole plant. Mining and milling are not æsthetic occupations; they are nothing but plain and cold-blooded business affairs, the prime and sole object of which is to make money. The greater the ultimate net profit per ton of ore mined, the greater is the efficiency of the plant, regardless of whether the whole plant looks spick and span or whether it looks distressingly like a junk-shop, and regardless of whether the tailing carry high assay-values or the concentrate be low-grade.

Low tailings and clean concentrates are generally, but by no means always, an indication of good economic recoveries. Local circumstances often strangely affect the economic efficiency, and fully justify practices which, at first sight, appear to be patently wrong. Therefore it is a good idea when entering a plant where some practices appear obviously incorrect, to inquire thoroughly about the local circumstances before making any critical remarks. I say that out of personal experience. If the men on the place are doing something in a certain way, there

are nine chances out of ten that they have some good reason for doing so.

The economic efficiency is the resultant of many and disparate factors, some of which converge while others work in opposite directions. These factors are so numerous that they cannot all be enumerated. The four leading ones are:

- Metallurgical efficiency,
- Freight and transport charges,
- Smelter schedule,
- Operating cost.

To these are to be added the presence or absence of deleterious minerals, such as lime and magnesia in a zinc concentrate; the zinc, arsenic, and antimony in iron or lead concentrates; minerals of high specific gravity; and so forth.

Let us now analyse more closely these various factors and see in which way and to what extent they influence the economic efficiency, and how one factor will counterbalance and at times completely offset some of the other factors.

The only case where the metallurgical efficiency is almost identical with the economic efficiency is in the case where the final mill-products are metallic.

One instance is that of gold and silver ores not requiring concentration. Such ores are treated directly by amalgamation, by the cyanide process, or by a combination of the two. The ultimate products of such plants consist of gold and silver bars, which are sold at full market-value; the refining and transportation charges are negligible factors in the economic efficiency. A second example is instanced by the native copper ore of Lake Superior. With such an ore the profit is generally in direct proportion to the metallurgical recovery. However, there are exceptions even in such cases. As an example I shall take the case of a straight gold and silver cyaniding plant of limited capacity. The gold, that is, such part of it as can be dissolved, generally passes into solution within a comparatively short time; the silver instead dissolves far more slowly and it may take several days and repeated treatments with strong cyanide solu-

tions to reduce the tailing to its minimum silver content.

Let us suppose, for example, that the ore assays 8 dwt. gold and 3 oz. silver. Expressed in dollars, it means, roughly speaking, that the ore is worth \$8 in gold and \$1.50 in silver. Whatever gold is soluble (perhaps 90% of it) will probably have passed into solution within the first 12 hours; during the same period probably only one-half of the silver will have passed into solution. It may take 48 hours further treatment to reduce the tailing-values to their minimum, and during this period probably only one-half of the silver residue and a few cents in gold will be dissolved. Altogether, the 48 hours further time will probably not represent much more than half-a-dollar increased profit.

By using the long treatment the capacity of the plant is reduced to one-third; against the 50 c. per ton of increased profit is to be debited the interest charges of the capital invested on the plant, the increased cost of production and treatment per ton of ore, and also the increased cyanide consumption, as there is always a cyanide loss, which is directly proportional to the number of contacts between the solution and the ore. Therefore it is evident that the long treatment is not profitable in a case similar to the one taken as an example. It is good business policy then to let some of the contents go to loss; the net profit per ton of ore treated will be greater, and so always will be the total net revenue per day.

This discrepancy between the metallurgical and the economic recoveries are especially marked in ore-dressing plants. It is least marked in the concentration of copper ores; it is especially noteworthy in that of auriferous pyrite ores and still more as regards galena and blende ores. The discrepancy hinges on the fact that in any concentrating plant, under normal operating conditions, the metallurgical efficiency and the grade of the various concentrates always fluctuate in opposite directions; that is, the metallurgical recovery can be increased by lowering the grade of the concentrates, and the grade of the concentrates can be raised only at the expense of the metallurgical recovery.

However perfect a plant may be as to design and operation, there is always some mineral going to loss and some gangue will find its way into the concentrate, this imperfection being due to the fact that there is no definite line of demarcation between concentrate and tailing.

In any ore-dressing plant, whatever be the type of machinery used, there is always some middling produced. This middling, and especially that part of it that is produced by the coarser concentrating machinery, is usually re-treated in some way or other, but, whatever be the flow-sheet of the plant, it is evident that the middling will eventually arrive at some point along its course of treatment where a final decision must be passed as to whether it be allowed to enter the concentrate or be sent to waste with the tailing.

In most cases mill men have but a vague idea as to the true nature and value of the middling. The dividing point between concentrate and tailing is chosen somewhat at random, the colour being taken more often as a guide than the actual commercial value of the material in question.

This is illustrated in the diagram on the opposite page, which represents one of the Wilfley tables of the Bunker Hill & Sullivan concentrator. This table was sampled every two inches. The upper black line represents the percentage of lead and the lower one the ounces of silver per ton. The two dotted lines represent, in their proper scale, the net value per ton at each individual point along the discharge-lip of the table. Of these dotted lines the upper one gives the net value when the market price of lead is \$5 per 100 lb. and silver is at 70 c. per ounce. The lower line gives the net value, when lead is at \$3.50 per 100 lb. and silver at 50 c., that is, for low market-values of the metals.

The diagram proves that the tables have to be operated differently according to the variation in the market-prices of metals. So also if some modification was made to the smelter contract, the curve representing the net value per ton would vary accordingly, and it would be necessary to change the point of separation between concentrate and tailing.

An accurate analysis of this kind at times brings some startling revelations. In the specific case taken for example (and this example is based on actual experimental data), the grade of the material, the commercial value of which is zero, lay between 17 and 12% lead and between 10 and 7.5 oz. silver, according to whether the prices of metals are low or high. A 14% lead tailing seems shockingly high, but these figures cannot be disputed; it may be worth while to re-treat the high-grade portion of this tailing and this is what is being done, but the point beyond all discussion is that under no circumstances should any pound of material assaying less than 14% lead and

8 oz. silver be admitted in the concentrate.

The example just analysed illustrates a case where the discrimination between concentrate and tailing is entirely dependent on the intrinsic value of the material itself. There are other cases, however, where the addition of low-grade middling to the concentrate is sufficient to lower the average grade of the concentrate to such a point that the unit-prices paid for the metals are also reduced thereby, causing a heavy loss. As an example let us suppose that the ore in question be an auriferous pyrite in quartz and that the average concentrate will assay: 2 oz. gold and 5.4% lead.

Let us suppose also that the smelter contract under which the concentrate is sold, reads as follows:

duced to below 5%, and therefore no payment is received for lead.

Profits and losses become as follows:

Nine tons of original concentrate:

Gold, 18 oz. @ \$19.....\$342'00

Lead, 48.6 units @ 40 c..... 19'44

Total.....\$361'44

Less treatment on 9 tons..... 45'00

Net return.....\$316'44

Ten tons mixed concentrate:

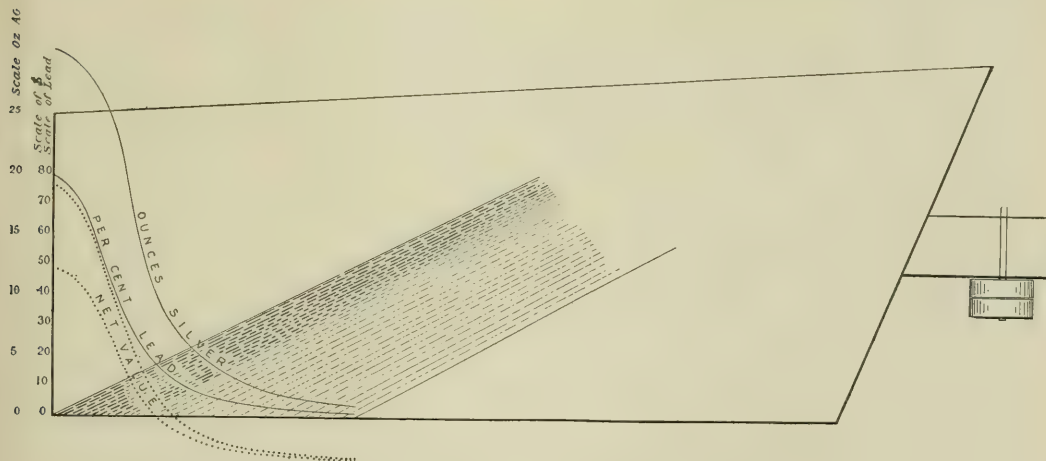
Gold, 18.35 oz. @ \$19.....\$348'65

Less treatment..... 50'00

Net return.....\$298'65

Net loss.....\$ 17'79

Loss per ton..... 1'78



STUDY IN CONCENTRATION AT THE BUNKER HILL & SULLIVAN.

Gold @ \$19 per oz.

Lead. No payment under 5% lead; 40 c. per unit for contents above 5%.

Treatment charge \$5 per ton.

In milling the ore we find that for every nine tons of concentrate produced we obtain also one ton of middling assaying as follows:

Gold..... 7 dwt.

Lead 2.5%

Zinc..... 16%

This middling contains \$6.65 in gold, and as the treatment charge is \$5 per ton, there should be a profit of \$1.65. It is easy to calculate that by adding this middling to the concentrate the average grade of the concentrate will be 1.83 oz. gold and 4.96% lead.

This shows that owing to the addition of the low-grade middling the lead content is re-

This goes to prove how an apparently profitable operation can in reality cause a substantial loss.

Other important factors to be kept in consideration in the economics of milling are the transport and treatment charges. There is first of all a charge for hauling the concentrate from the mill to the railroad unless the mill is built close to the railroad tracks, and this charge will range from \$3 to \$20 per ton, according to the distance. In addition to this there are the railroad freight-charges for hauling the concentrate from the loading station to the smelter, and these will range from \$3 to \$12 per ton. Finally, the smelter will charge from \$2 to \$12 per ton for the privilege of smelting the ore.

All these charges naturally will vary owing

to local conditions, but, whatever the cost may be, there will always be a total transport and treatment charge that will range from a minimum of, say, \$5 per ton to \$20 and even \$30 per ton. When the mill is in relatively inaccessible districts, these total charges may be at times much higher. In most cases the transport and treatment charges amount to about \$9 to \$14 per ton.

These charges are debited against every ton of product shipped from the mill, whether it be high-grade or low-grade, and every individual ton of material that is not rich enough to more than offset all the charges debited against it is not worth shipping. In remote districts I have seen concentrates containing \$20 and \$30 per ton in gold and silver thrown on the dump as worthless material. There it will remain until some day improved transport and smelting facilities will transform this material from waste into a valuable product.

Mill operators often delude themselves about the shipping of low-grade ore and mill-products. They may have on hand a large tonnage of high-grade ore and a few tons of low-grade material, and they resort to the ingenious device of mixing the two together. In doing so they flatter themselves that they are skilfully smuggling the low-grade material to the smelter, not realizing that they are losing exactly the same number of dollars and cents as if the two materials had been shipped separately.

To illustrate this, let us take a simple case. A gold ore is being paid at the rate of \$19'50 per oz. gold, and the total transport and treatment charges are \$15 per ton. We have two tons of ore. One ton assays 3 oz. gold and the other 0'7 oz. The first ton is therefore worth \$58'50 for its gold content; this, less \$15 charges, is equal to a net value of \$43'50. The second ton of ore is worth \$13'65 for its gold content; the total charges are \$15, and the loss on this material amounts therefore to \$1'35.

If we mix the two tons of ore together, we shall have 2 tons averaging 1'85 oz. gold and having a total net value of \$42'14. This corresponds exactly to the difference between the profit realized on the first ton and the loss suffered on the second ton.

Summarizing: we have considered two cases in which it is profitable to keep a low-grade material out of the concentrate. In the first case the adding of low-grade material lessened the unit-prices paid for the metal. In the second case the transport and treatment charges more than offset the assay-values

contained in the low-grade material. At times both these conditions may co-exist.

On the other hand, there are conditions when it pays to throw some low-grade material into the concentrate. Some years ago I was operating a large lead-silver plant. I found myself confronted with the problem of what to do with some peculiar material. It was the last spigot-discharge of a spitzkasten and consisted of very fine slime, almost colloidal. The slime contained 15'5% lead and 7'9 oz. silver. The best recovery we could obtain by concentrating this slime on vanners was 15% of the lead and 11% of the silver. The price of lead and silver were high at that time. The profit by concentration per ton of dry slime treated was estimated at \$1'32. By shipping the slime directly to the smelter we realized \$4'69, and therefore this vanner-feed was mixed with the slime-concentrate and shipped to the smelter. The reason for mixing the two products was that the smelter would have refused to accept this low-grade material if shipped by itself.

This is one example illustrating a case when the mixing of two mill-products becomes profitable.

Another instance was lately brought to my attention in Colorado. The mill was producing two concentrates. One was a 60% lead product containing about 6% zinc; the second was an iron concentrate assaying about 16% zinc, all zinc in excess of 10% being penalized, as customary. Both concentrates were being sold under the same smelter-schedule and at the same rates; by mixing the two concentrates the total mill-product assayed less than 10% zinc, and by this expedient the zinc penalty was avoided without in any way decreasing the value of the concentrates.

There are instances, as I have just shown, in which there is a profit in mixing the concentrates. More frequently, however, the profit lies in keeping the concentrates separate, and even to increase, to some extent, the subdivision of the products. The reasons for so doing may be of different natures; they may depend on freight-rates, from the way the smelter-contracts are framed, or from the co-existence of two or more smelter-schedules.

In most localities freight-rates are progressive, that is, high-grade ores pay higher freight-rates than low-grade ores. On a certain Colorado railroad, for an instance, the freight-rate on ores worth less than \$30 per ton is \$3, and on ores worth more than \$100 per ton it is \$5'50. At one of the plants in this dis-

strict the mill produces a high-grade lead concentrate and a low-grade iron product. It is the aim of the mill-superintendent to keep the low-grade concentrate below \$30, so as to take advantage of the low freight-rates for the largest possible tonnage of concentrates produced. Any high-grade material, as that obtained from the quicksilver traps and from other parts of the mill, is therefore thrown into the lead concentrate, which, being high-grade, is already charged with the maximum freight-rate.

any grade for smelting silicious gold and silver ore, and, to get all the lead supply they can, they will offer favourable treatment-charges even for low-grade concentrates, though the unit-price offered may not be as high as that offered by the first mentioned smelter for the high-grade concentrate.

Moreover, the trans-continental freight-rates are so arranged that it is cheaper to send one pound of lead from the Western States to the Atlantic Coast under the form of lead concentrates assaying not less than 70% lead, than



BUILDING THE FOUNDATIONS OF THE TAQUAH 50-STAMP MILL, WEST AFRICA.

Other economic advantages can be derived from the co-existence of two or more smelter contracts. The smelter contracts are generally arranged on a sliding scale and the terms of the contract vary according to the special desire of the smelter to receive one kind of ore or another.

Some smelters, owing to the metallurgical process they follow, need chiefly high-grade lead concentrates, that is, concentrates assaying about 60% lead. Accordingly, they offer high unit-prices for clean concentrates and very low prices for low-grade concentrates.

Other smelters may need concentrates of

it is to ship that same pound of lead as bullion. This differentiation in the freight-rates enables the smelters in New Jersey to offer better rates for the very purest lead concentrates that can be offered by any of the Rocky Mountain smelters.

Thus we have here three different smelters, one offering good prices for low-grade lead, another offering better prices for the high-grade lead, and the third offering special inducements for the very cleanest concentrate that can be produced in the mill. Now let us suppose that a company has contracts with each of these three smelters. Almost any

machine in the mill will yield various grades of concentrate and it is an easy matter to keep these products separate as they are delivered by the machines. By doing so three grades of concentrate can be produced and each concentrate sold at best advantage.

Another question of great economic importance and of frequent application is that of smelting as against concentrating.

At the Bunker Hill & Sullivan mine the ore consists of silver-bearing galena in siderite and quartz gangue. The ore, assaying on an average 12% lead, is too low-grade to be smelted directly, and accordingly is concentrated with jigs and tables. The jig-middling, consisting chiefly of siderite containing finely disseminated galena, will analyse approximately :

Silver.....	4.5 oz.
Lead	10%
Iron	31%
Silica	6%
Sulphur	4%

The sulphides are so finely disseminated that the re-treatment of this jig-middling shows only a recovery of 55% of the lead and 50% of the silver.

On the other hand, this middling is an ideal material for smelting, being a lead ore low in sulphur and silica and high in iron. On this account the smelters have been able to offer especially good prices and low treatment-charges for this material, making it more profitable to the mining company to ship this low-grade material directly to the smelter than to attempt to concentrate it any further by re-grinding and table concentration.

So also, in the concentration of copper ores, there are instances where, owing to the oxidized character of the surface ore, it is unprofitable to attempt to mill it; in other cases the presence of garnet or other heavy gangue makes it impossible to concentrate the ore.

Lately at the Goldfield Consolidated some of the ore from the lower levels has been shipped directly to the smelter, though not being of much higher grade than the average mill-feed, solely on account of its high copper content, which caused an undue cyanide consumption when cyaniding the mill-tailing.

The cost of operation is another item that, to a great extent, influences the milling practice. Where low-grade ore is being treated, it is essential to reduce the costs to the minimum. The simplest way to do this is to increase as much as possible the tonnage of ore treated.

In most plants the mills or cyanide plants are of limited and generally insufficient capa-

city; circumstances frequently do not warrant the increase of the capacity of the plant by adding further equipment, and the manager finds himself under obligation to do the best he can with the means at his disposal. This compels him to crowd the mill machinery to its utmost capacity; it necessitates shortening the period of treatment in the cyanide vats and of avoiding as much as possible any delays or shut-downs. It is impossible to crowd a plant without impairing its efficiency, but when treating low-grade ore the losses resulting from the decreased efficiency are often more than compensated by the decreased operating cost.

We must remember at this point that the mill, whatever be its kind, is the throttle regulating the operations of the whole plant. If the mill becomes choked or has to shut-down, the mine must accordingly reduce its output or suspend operations. An increased capacity of the mill corresponds to an increased output from the mine, and will reduce not only the operating cost in the mill but also that of all the plant in a general way: the overhead charges, the costs of maintaining a town office, the assay-office, the engineering staff, etc., all will be reduced and in most cases there is more money saved by these reductions than is lost in the mill owing to a decreased efficiency of plant.

As an illustration, we can take the Utah Copper Co.'s operations. This company is handling the lowest grade copper sulphide ore mined in the world. To be successful, as this company has been, it is dependent chiefly on three factors in the mill. These are: capacity, full load, and continuity; that is, the plant must be of ample capacity, it must be kept at full load and operated continuously. In doing this the Utah Copper Co. has succeeded remarkably well.

When a concentrating plant is operated in connection with a cyanide plant other considerations come into play. The two plants are intended to work in unison and it is immaterial whether the recovery be effected in one plant or the other. The best policy, therefore, is to balance the two plants in such a way that the best economic efficiency may be obtained. The aim of the concentrating plant must be that of removing as much as possible all the sulphides that cannot be treated by the cyanide plant. Frequently the sulphides cause a heavy cyanide consumption and it pays to recover as much of these sulphides as possible even if the concentrate produced be very low-grade. The losses due to the freight and

treatment charges on this low-grade concentrate will be offset by the reduced cyanide consumption.

On the other hand, there are plants where the sulphides in the ore do not affect the cyanide solution to any marked degree, and at the same time do not readily yield their gold and silver contents to the solutions unless they be crushed to an impalpable powder. In such a case it is necessary to separate the coarse sulphides by ore-dressing, and the concentrate may either be shipped directly to the smelters, or, after being slimed in tube-mills, it may be sent to the cyanide plant together with the tailing. Where such conditions exist there is no special reason for attempting to separate the sulphides contained in the slime, as these minute particles of sulphides will cyanide without difficulty and often yield a higher economic recovery by the cyanide process than can be obtained by the smelting of the concentrate.

The cyaniding of concentrates, as against smelting, is another subject of great economic importance and in these last few years has been receiving more and more attention. When a concentrate can be cyanided, the gold and silver are realized in the form of metallic bars for which the producer receives payment at full market-value. Against this process are to be charged the cost of treatment and tailing-losses. On the other hand, against the smelting of concentrates are to be charged the discounts made by the smelters on the gold and silver contents, the cost of transport and smelting, and a few other charges, like that of interest on the value of the concentrate during transit.

The question whether it be best to cyanide the concentrate or sell it to the smelters hinges entirely upon the question whether the cost and loss by cyanidation be more or less than the cost and charge debited to smelting.

The main difficulty in cyaniding concentrate is the heavy cyanide consumption, but in many instances this loss can be obviated by roasting or by giving preliminary treatments to the concentrate. In some localities the concentrates will readily cyanide after being slimed and where such conditions exist this process is responsible for greatly raising the economic efficiency of the plant. This question of cyaniding the concentrate must be especially kept in mind in localities that are remote from the railroad, as the successful operation of the mine may depend entirely on the solution of this problem.

The best example I can give of the practice

of cyaniding a concentrate is that of the Treadwell plant. W. P. Lass has fully described the process in the transactions of the American Institute of Mining Engineers. At Treadwell the total loading, transport, smelting, and deduction charge per ton of concentrate was close to \$12 per ton. At present the cost of cyaniding the concentrate varies from \$2.70 to \$3, and the loss in the tailing ranges from \$1.80 to \$2 per ton, so that the introduction of this process represents a net profit of about \$7.25 per ton of concentrate treated.

The various considerations we have been debating all tend to emphasize the fact that the ultimate object of any reduction plant is that of obtaining the maximum economic, and not the maximum metallurgical, efficiency. So many and widely disparate factors affect the economic efficiency that the metallurgical treatment itself becomes affected thereby; the metallurgical treatment must change as the factors affecting the economic efficiency become changed and every modification in freight-rates, every new smelter contract, and every variation in the character or grade of the ore will call for some modification of the flow-sheet or re-adjustment of the machinery.

It is the principal duty of the metallurgical engineer or mill-superintendent to watch these ever-changing conditions. The operation and routine work he can leave to the foreman and shift-bosses, devoting a good part of his time to the business side of milling. Mining is not only a technical but also a commercial enterprise, and a manager must be just as good a business man as he is supposed to be a good engineer. It is the dollars and cents that he can squeeze out of the ore that go to make his reputation far more than his technical abilities.

The Production of Gold in New South Wales during 1912 was 165,295 oz. worth £702,129. Of this, 18,899 oz. worth £80,276 was obtained from dredging operations. Dredging for gold was started in 1900 and the total production has been 348,603 oz. worth £1,480,774. The best years were 1907 and 1908, when 36,136 oz. and 37,917 oz. respectively were obtained. Since then the output has steadily declined. The results obtained at the tin dredges have shown great regularity since 1907. The recovery in 1912 was 1621 tons of concentrate selling for £223,813. The total yield of concentrate since 1900 has been 12,187 tons, selling for £1,273,068. It is stated that the areas now being dredged for gold are being rapidly depleted. Nearly all the tin comes from the northeast corner of the state.

CAM & MOTOR METALLURGY

Method of Treating a Rhodesian Gold Ore containing Arsenic and Antimony.

By GORDON F. DICKSON.

THE Cam & Motor property consists of 226 claims held under the Mines & Minerals Act (1903) and is situated at the Eiffel Flats in the Hartley mining district of Southern Rhodesia. It was originally acquired under option in 1910 by the London & Rhodesian Mining & Land Co., and as the result of an extensive scheme of development the property was purchased and the present company formed in 1911.

The two principal orebodies are the Motor & Cam-Good Shepherd. The Motor lode strikes north and south, and underlies west, while the Cam-Good Shepherd workings extend eastward from near the northern end of the Motor workings. The Cam & Good Shepherd mines were originally separate properties, but the latter was purchased from the United Rhodesia Gold Fields by the Cam & Motor Gold Mining Co. in May 1911.

During the past two years work has been almost wholly confined to the Motor lode, which is opened up to a depth of 630 ft., there being a total of nearly 16,000 ft. of development accomplished. The orebody is a quartzose mass of sedimentary origin occurring as an impregnation of the normal sediments with secondary minerals. The hanging-wall rocks consist of a series of interbedded quartz grits, quartzites, and finer slates, while the foot-wall is a fine-grained highly altered crystalline rock of allied character, chiefly augite-andesite. The typical ore is a greyish-green compact rock containing quartz and calcite, iron and arsenical pyrite, also some stibnite being present.

The Motor lode, as already stated, strikes north and south, and it dips at an angle of 75° west, there being a tendency to curve eastward at both ends. The average length of ore proved is 1000 ft., while the width of the lenses is from 8 to 100 feet.

The Cam-Good Shepherd orebody trends east and west, and dips south at 70°. There appears no doubt that this is the same line of lode as the Eileen Alannah, the workings of which mine extend to within a few feet of the Good Shepherd boundary, and from that point to the Good Shepherd workings there is an undeveloped length of 1350 ft. on the line of

lode. Nearly 3000 ft. of development has been done, the Cam mine being opened up to a depth of 500 ft. and the workings connected with the Good Shepherd at the various levels down to 300 ft. The country-rock on both sides of the lode-channel is of an igneous type, closely resembling that on the foot-wall of the Motor lode, and while the characteristic minerals are similar, there is more quartz and secondary carbonates, also some chlorite present.

The Petrol is a comparatively recent discovery and only a limited amount of development has so far been done. The ore closely resembles that of the Motor lode, the country-rock being the same as that enclosing the Cam & Good Shepherd lode. Although a length of 200 ft. of ore of the same average grade as the Motor & Cam has been proved, it is interesting to note that this has not been included in the published ore reserve of the company.

The following analysis gives the principal constituents of the Motor ore:

	%
Silica, SiO ₂	44.33
Iron Pyrite, FeS ₂	2.95
Mispickel, FeS ₂ , FeAs ₂	2.15
Stibnite, Sb ₂ S ₃	0.15
Calcium Carbonate, CaCO ₃	14.10
Magnesium Carbonate, MgCO ₃ ...	26.10
Graphite C.....	Traces

In some parts of the Motor mine both stibnite and graphite occur in somewhat greater proportions than shown in the foregoing analysis. During the whole course of experimental treatment, however, when parcels of sulphide ore were taken from various parts of the mine, no trouble was experienced through the presence of these minerals, that were not easily overcome. Laboratory experiments were first carried out on representative samples of raw ore, but it was proved conclusively that this form of treatment was neither economical nor satisfactory, owing chiefly to the excessive consumption of cyanide and loss of free alkali through decomposition of the existing minerals.

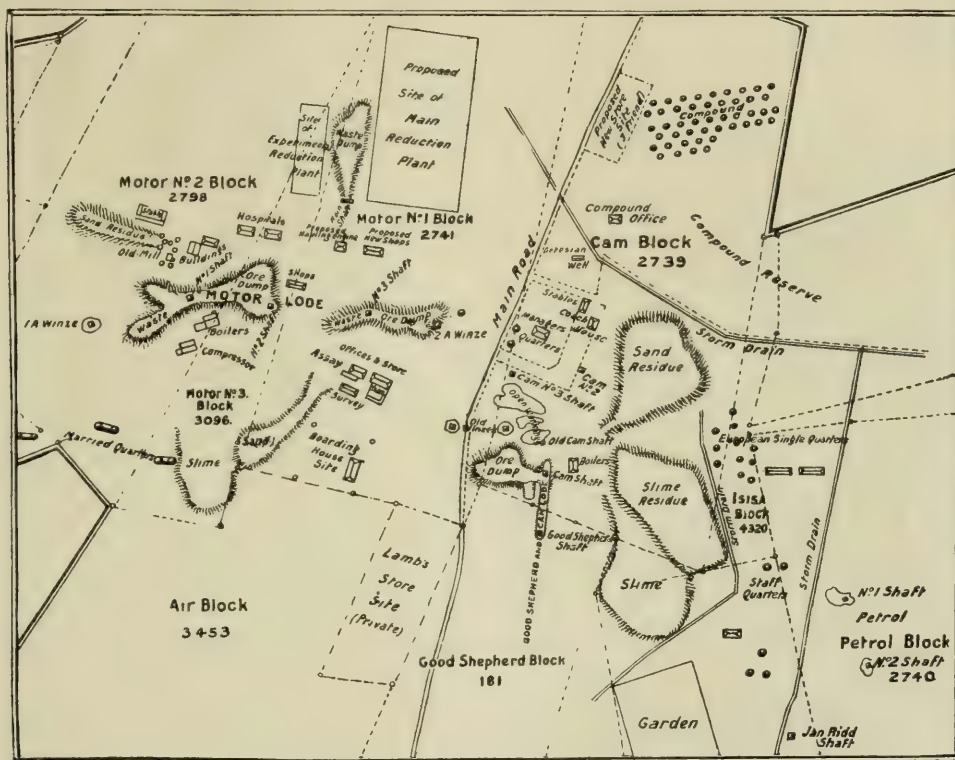
Attention was then directed entirely to roasting methods, and after a number of pre-

liminary tests, which showed a high percentage of extraction, more exhaustive trials were made on larger quantities, from which fully confirmatory results were obtained.

The following is a brief history of this latter work. A large number of samples of sulphide ore were crushed to pass a 10-mesh screen, and after being quartered down, were put through a pulverizer, the final product all passing through a 30-mesh screen. Samples were then taken for roasting, which was done

Owing to the fusibility of the stibnite, it was found that care was required in roasting. If the temperature in the muffle was raised too rapidly, globules were formed; these were very difficult to oxidize and eventually affected the recovery.

In the subsequent treatment with cyanide the carbonates of magnesium and calcium were found to have a useful effect in maintaining the protective alkalinity of the solutions.



PLAN OF THE CAM & MOTOR COMPANY'S PROPERTY.

in a Morgan L L muffle fired with coal, rapping being effected by a diamond-shaped hoe. In all experiments a commercial roast was obtained in 45 minutes, but the charge was usually allowed to remain in for 60 minutes, when, on testing by Brinsden's method, the ore was invariably found to have had a 'sweet' roast. Subsequently, when leached or agitated with cyanide solution, an average extraction of 85 to 86% of the gold contents of the ore was obtained.

Special tests were also made on samples to which was added a proportion of both stibnite and graphite above the average quantity contained in the ore, without any appreciable difference being discovered in the extraction.

The prominent points discovered as the result of these experiments (which occupied a lengthy period) were as follows :

1. That with care, and the admission of sufficient oxygen, a perfectly 'sweet' roast was obtained easily.
2. There was no decrease in the rate of extraction, when more than the average quantity of stibnite was present.
3. The dissolution of gold was rapidly effected.
4. The consumption of cyanide was low, and there was a high final protective alkalinity.

Notwithstanding the satisfactory results obtained from the work of testing, the question

of erecting an experimental unit was given weighty consideration by the board of directors, and eventually agreed upon, it being realized that in addition to obtaining complete confirmation of the results of tests, a lot of useful knowledge would be gained as regards the cost of treatment, and of details that would be useful in connection with the arrangement of a large plant.

The experimental plant was started in November 1911, the work being under the charge of Mr. B. L. Gardiner, the company's metallurgist. The arrangement of the plant is as follows:

- 15 by 9 in. rock-breaker.
- No. 5 Krupp ball-mill.
- Edwards duplex furnace.
- 5-ft. grinding-pan.
- Vacuum-filter.
- Mechanical agitators.
- Leaching-vats.
- Precipitation.

The capacity of the plant was estimated on the amount of ore that could be satisfactorily roasted daily by the simplex furnace, and all necessary arrangements were made for keeping full data and statistical records of results.

For the first three weeks only a small daily tonnage was put through, but it was gradually increased until the roasting-furnace was run under Kalgoorlie conditions. At this stage a rise in the assay of the residue was noticed, and for a further period the extraction dropped from 85 to 78%. The cause was eventually discovered to be entirely owing to the tendency of the ore to ball and sinter at the discharge end of the roaster. Arrangements were then made to lower the temperature of the finishing hearth by firing more lightly, and by opening the end and side ports, with the result that the extraction was again brought up to just over 84%. Roasting was thereafter carried out on the 'cool finish' lines, and during the following two months (December and January) efforts were directed to obtaining the maximum tonnage possible under these conditions, with satisfactory results as regards extraction.

After this was accomplished, firing with coal was commenced and comparisons were made over regular periods with both wood and coal for the purpose of ascertaining the most suitable fuel from the standpoint of economy and efficiency. The question of the cost per ton of ore roasted is necessarily a most important one, and, during the progress of the respective trials, careful records were kept with the result that apart from any question

of efficiency, the use of wood-fuel worked out at an appreciably lower figure than coal. The chief reasons for this is that there is available within 10 to 12 miles of the mine several years' supply of excellent fire-wood, which can be delivered at a proportionately lower rate per ton than coal from the Wankie collieries, chiefly owing to the long distance the latter has to be brought by rail and the special high freight-rate charged on the branch line between Gatooma and the mine.

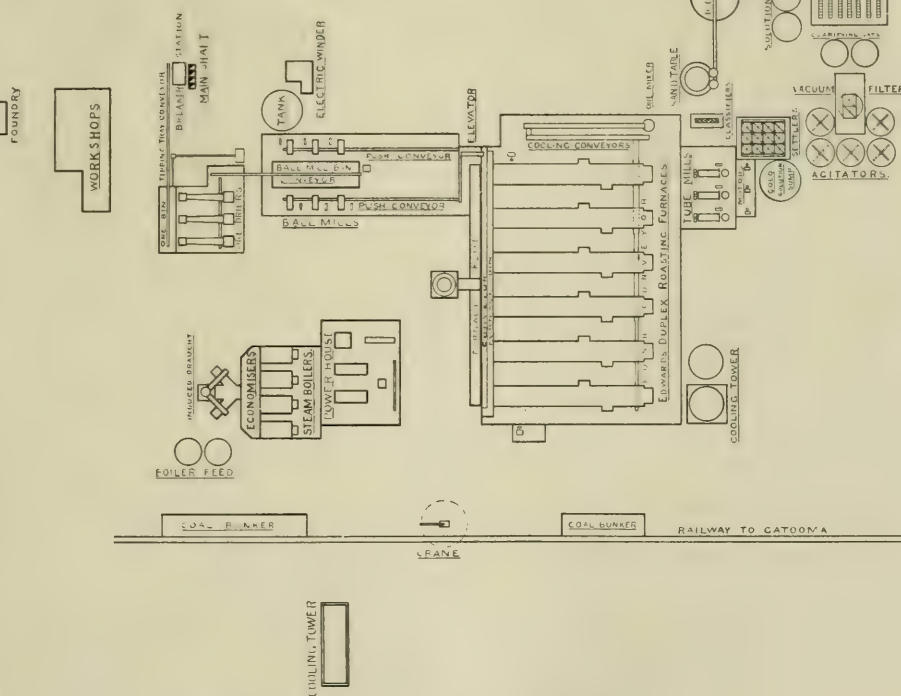
It is, however, realized that not only is the available supply of fire-wood far from being inexhaustible, but that the conditions may be changed, through the possibility of coal being ultimately obtainable at a cheaper rate, either from the opening up of the known coal areas in the Lomagundi district or through a substantial reduction in the present railway-rates. It was, therefore, eventually decided to construct the fire-boxes of five Edwards' furnaces for burning wood, but so that they could be at any time converted for using coal. The sixth furnace has been fitted with a Parkison patent fire-box of the type used at the Golden Cycle mill, in Colorado, which is arranged for the combustion of gases on the 'producer' principle. It is claimed that the long incandescent flame, which makes wood such ideal fuel for roasting, can be obtained with the Parkison fire-box, and that by proper regulation of the secondary air, any length of flame required can be obtained up to 60 ft. The final decision was not reached without careful thought in view of the fact that the opinion of the consulting metallurgists on the particular question as to the class of fuel that should be used was not entirely unanimous, and it can be seen that the compromise eventually agreed upon thoroughly safeguards the position, while the important consideration of cost is made a prominent one.

Classification and treatment of the product after roasting was exhaustively considered during the experimental stage, and it was eventually decided that the fineness to which it was necessary to grind the ore to obtain a satisfactory extraction from the most economical point of view was somewhere about 40 mesh. Experiments carried out on the sand-residue from the leaching vats showed that after being all ground to pass 100 mesh and agitated with 0.14% cyanide solution for varying periods, the additional extraction did not justify the higher cost of all-sliming. The plant therefore is arranged for separation of all the sand and slime, the former being treated by leaching and the latter by the vacuum

process in a filter of the fixed submerged-leaf type. It was proved in the experimental plant that through the removal of the comparatively small percentage of sand and the proportion of natural slime remaining, the cakes held well on the frames and a perfectly satisfactory extraction was obtained on the cheapest possible lines. With regard to the question of leaching, it will be seen from the plan of general arrangement, and from the de-

sand as will be the case in the large plant, and the effect of the lime carbonate in the ore will be more of a beneficial nature than otherwise, in maintaining the protective alkalinity and thereby reducing cost. The new plant, which has been designed to have a minimum capacity of 15,000 tons per month, has all been shipped and the work of erection is well advanced. Delay occurred in deliveries of certain portions owing to the effect of the

CAM AND MOTOR C.M.C.^oL.^o TREATMENT PLANT.



tailed description with which I shall conclude, that the fine sand from the tube-mills after preliminary separation will gravitate to a Caldecott cone, where, after being dewatered, it will pass over a Caldecott sand-table, from which a perfect leaching-product will be obtained, washed free of slime. I may add in this respect that at no time during the course of treatment with the experimental plant was any setting or cementing of the ore in the vats experienced, such as has been suggested, even when it was not possible to obtain such a clean

strikes, but notwithstanding this it is expected that the whole plant will be ready for a start before the end of the year.

The following is a brief description of the general arrangement: The ore will be hauled from the mine in 3-ton skips and delivered on to grizzlies over the fine-ore bin. The over-size will gravitate to a 30 by 18 in. jaw-breaker to be broken to $3\frac{1}{2}$ inch cubes, which after again passing over grizzlies with two-inch spaces will be broken down with two 16 by 9 in. rock-breakers to 1-inch cubes. From

the rock-breaking station the ore will be elevated and distributed by a tipping tray-conveyor over steel ore-bins, from where it will be fed automatically into the three No. 2 Argall dryers, which are arranged for induced draught and with a canvas tube dust collector. From the dryers the ore will be delivered on to a tipping tray-conveyor, and this will convey, elevate, and distribute the dried ore to the large steel ball-mill bins. During transit of the ore between the dryers and ball-mill bins, a 1% sample will be automatically cut out and ground in a No. 3 ball-mill. From this accumulation, a sample weighing 100 lb. will be broken daily, the remainder being returned to the circuit. It will be noticed that the ball-mill plant consists of six No. 8 Krupp mills, three being on each side of the central bin, with an arched way in the centre for the 24-inch conveyor.

After being reduced to pass 20-mesh, the ore will be conducted by push-conveyors and raised in a belt-and-bucket conveyor to the furnace-bin, where, by means of a push-conveyor, it will be distributed over the full 200 ft. length of the bin. The elevator will deliver into one end of the push-conveyor and, for the first 8 ft. of its length it will be closely boxed, leaving sufficient room only for the blades to swing, so as to confine the dust as much as possible. The boxing will be wholly or partly removable for the purpose of examining and repairing the conveyor when necessary. The belt-and-bucket elevator, which will also be closely cased, will be provided with a fan to remove the dust and deliver it with the ball-mill dust to the cyclone arrester. From the furnace-bin the ore will be automatically fed into six Edwards' duplex furnaces, each of 56 rabbles, and from these after roasting, large cooling push-conveyors will deliver it into the mixer. From the mixer, by a 5-inch centrifugal sand-pump, the pulp will be raised to the classifier, which divides it into three products, namely, coarse sand, fine sand, and slime. The coarse sand will go direct to the three tube-mills to be reduced to fine sand and then returned to the mixer. The fine sand will be delivered to the Caldecott cones and sand-tables, where, after removal of the bulk of the solution, it will be carried by a travelling-tripper belt-conveyor to the four 36 by 8 ft. leaching-vats.

The slime will be delivered from the classifier to a nest of spitzkasten, and there de-watered and thickened to 45-50% solids, before being fed into the mechanical agitators, which are of the ordinary revolving-arm type.

The vacuum-filter will be 19 ft. long by 10 ft. wide, and 7 ft. deep with two 60° discharge-hoppers. It will contain 50 leaves, giving approximately 3300 square feet of surface.

The residue will be dropped into an agitator underneath the filter, whence it will be pumped to the dam.

Ordinary zinc precipitation with shavings will be employed.

The power will be supplied by four Babcock & Wilcox water-tube boilers, each with 2852 sq. ft. of heating surface and fitted with chain-grate stokers, integral superheaters, and Green's fuel economizers, also with induced draught, having both electrical and steam-driven fans to avoid delay in case of accident.

Two Willans-Robinson turbines, each of 750 k.w. capacity at 300 r.p.m., will be coupled to two Siemens alternators supplying 3-phase current of 550 volts, 50 periods.

The power-plant includes a vertical high-speed air-compressor of 2500 cu. ft. per minute, a horizontal compound compressor of 800 cu. ft. per minute, and a 35 k.w. lighting set.

An electric hoist is being used for mine-haulage. The direct-current motor of 275 b.h.p. is connected to a 210 k.w. shunt-wound direct-current generator, the controller taking its supply from the mine-generating station.

The winding set is well equipped for safety, being fitted with a speed-limit device, also an arrangement to prevent withdrawal of the clutches until the drums are held.

The power-plant is considerably in excess of the requirements of the present reduction plant, but the latter is all arranged for extension in anticipation of further additions in the near future.

Production of Fertilizers.—The International Institute of Agriculture, of Rome, has published the following table of production of fertilizers throughout the world:

	Metric Tons	
	1910	1911
<i>Phosphatic fertilizers:</i>		
Mineral phosphates	5,344,981	6,055,073
Basic slag	3,275,845	3,485,500
Superphosphates	9,604,260	—
Guano	66,044	—
<i>Potash salts (for agriculture):</i>		
Potash salts (calculated as pure potash)	766,583	840,000
Indian saltpetre.....	15,581	15,273
Other potash fertilizers (calculated as pure potash)	—	40,000
<i>Nitrogenous fertilizers:</i>		
Nitrate of soda	2,432,949	2,487,000
Sulphate of ammonia	1,045,905	1,187,425
Cyanamide	30,000	52,000
Nitrate of lime	25,000	50,000

MINE MANAGERS AS VALUERS

Exploitation as against exploration. Management in relation to appraisals.

By MORTON WEBBER.

IN the June issue of *The Mining Magazine*, I was impressed by a contribution by Mr. F. E. B. Fripp, entitled 'Scientific Prospecting.' Mr. Fripp criticized the practice of employing mine managers in the capacity of valuing engineers. He points out that the reason for a selection of this kind is probably reputation gained in successful management. The contribution suggests that exceptional aptitude as an operator does not necessarily imply a similar qualification in the discernment of young properties possessing the earmarks of important mines.

These specialties are distinct in the major qualifications required, and only in a minor manner are they interdependent. When an operator is required to perform the function of a valuer, his selection is probably due to ignorant and illogical application of the maxim 'Nothing Succeeds like Success.' The profits expected of these relatively different types of engineer, I submit, are also different. In its broad aspect, the manager is expected to produce profit from ore and in developing additional ore in the mine that he may be managing. The valuer is expected to produce a maximum of profitable mines in proportion to properties proved unimportant when subjected to a preparatory scheme of exploration. Their common ground mainly lies in the intermediate stage of mine development. Broadly, the experience of the valuing engineer presupposes special ability in the laying out of early exploration in order to demonstrate the value of a property in respect to grade and size. Coincidentally, he should have special aptitude in laying out a development scheme that will permit the cutting of a loss with a minimum expenditure of time and money; and concurrently to give the property a fair trial.

Assuming the early exploitation of a deposit to be encouraging, continued exploration will merge finally into the more extensive and closer development of the mine for the removal of its ore. Here is the common ground of the valuer and manager. It is evident that both engineers should possess a thorough knowledge of the various systems of ore removal: the manager to produce operating profit and the valuer in the conceiving of an early

programme of development to arrange his method of attack to assist the manager in his subsequent constant and radical war against 'costs.'

Apart from the fact that assigning valuation work to managers is unfair to the valuer, who probably has utilized a considerable portion of his career in moving from place to place to gain experience of varied conditions, losing thereby the remunerative results that usually accrue through seniority, it imposes on the mine manager a responsibility for which he is poorly fitted. He will either consciously or subconsciously feel his deficiency in his new role, and careful of a well earned reputation in his own sphere, will err on the side of conservatism. With his mind trained to the security of ore reserves he will fail to realize that the most speculatively important epoch in the life of a mine is in its early existence. To the prospective purchaser life-extension, instead of being subordinate to ore reserves and general security of investment is, in my judgment, of paramount importance. A carefully formulated opinion of this aspect should constitute a primary part of a report. Its evasion or limitation by formula must handicap the usefulness of the mine-valuer.

In my practice as a valuing engineer, I know of two instances where young mines that subsequently became important producers were 'turned down' by mine managers sent to examine them. Both properties could have been bought on reasonable terms. The major purchase payments could have been delayed until the prime risk was eliminated, and the probability of success established. The reason why business was not done, in these instances, was probably because the engineers hoped to find, with these orebodies, conditions substantially identical with those obtaining at the successful mines with which they were familiar. Not finding these they failed for want of general knowledge of the construction of ore deposits to recognize the evidence of dissimilar but important deposits, which, on subsequent development, became valuable mines.

The reason underlying the inexpediency in employing mine managers as valuers may be

illustrated by a survey of the prime factors on which the valuation of a mine is based. The minimum of basal value of a mine is the net profit of its existing ore reserve. In the case of base-metal mines, this estimate should be computed on a metal price somewhere between the average over a past period, and the low peaks during cycles of trade depression. As

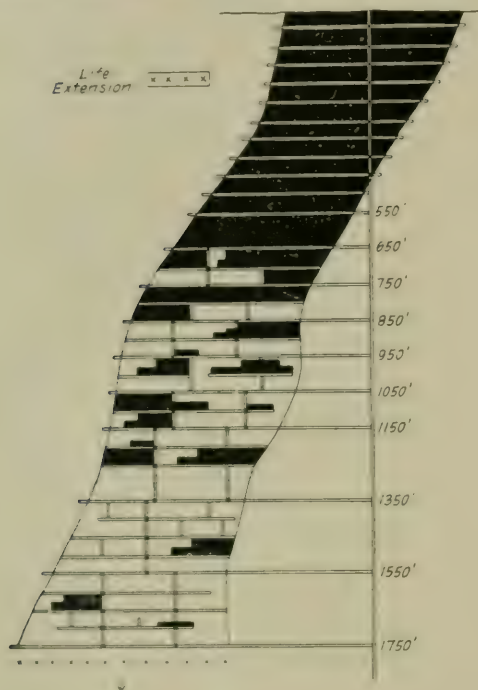


Fig. 1.

sub-normal metal prices are introduced to conservatively compute a metal market that can be relied upon, likewise, for the same reason, super-normal operating costs should be introduced. This result produces the A value of a mine. To this should be added the B value, or the asset of life-extension, which should represent the judgment regarding this individual case under five geologic heads. As the A value was founded on a sub-normal estimate of metal prices, the profits to be expected as the outcome of operating under normal metal marketing conditions should be introduced. This is the C value. To this should be added the D value, the result of expected operating economies, the outcome of modern plant and efficient management. In this way the total value of a mine may be regarded as $A + B + C + D$.

The manager is well fitted to deal with A, C, and D. If he has hewn to the specialty of management he has probably arrived at his present status partly through seniority, originality in the efficient daily working of a mine, native tact in handling a mine force, and general executive ability. Such experience does not of itself fit an engineer to competently consider the B value of a mine which should be based, as stated, on the following five geologic heads:

1. Character of the deposit in respect to past experience of the geology of similar deposits.
2. Size of the deposit in respect to length and width.
3. Secondary alteration.
4. Depth to which the mine has been worked.
5. Experience in the immediate neighbourhood as to the persistence and continuity of orebodies in depth.*



Fig. 3.

Both the training and experience of the mine manager, I submit, are in many respects different from those of the valuing engineer. While exceptions exist, it will be found on investigating the records of the managers of some of the world's important mines, that they have not had the opportunity of acquiring varied experience in the structure of ore deposits. In many cases they have held their

* 'Ore Reserves and Life Extension.' Morton Webber, *Mining and Scientific Press*, October 19, 1912.

* 'Estimating and Valuing the Future of Mines.' Morton Webber. *Mining and Scientific Press*, September 16, 1911.

positions for a number of years, which tends to rust their earlier knowledge of the varied nature of orebodies. In many cases a manager is given the charge of a property because of reputation gained in the successful operation of another mine exhibiting similar characteristics. Such a career must unfit him to deliver a competent prognosis of the B value of a mine.

Actual conditions generally furnish the best proof. I shall, therefore, submit a description of three gold mines possessing pronounced structural dissimilarity. I believe that the manager of any one of these mines would feel very much at sea if sent to examine either of the other two after several years continuous management of his own property. On the other hand, a specialist in valuation, because of the nature of his calling, would be 'where

by a private corporation. There are no popular market conditions to meet. Development has been primarily done in the search for new sources of ore-supply. Utilizing the major portion of the money allotted to development in this way is considered preferable to blocking out ore on four sides. The deposit is a replacement along a main fracture-plane in andesite. The impregnation of the walls varies within wide limits. This is characteristic of the deposit. Blocking out ore on four sides in a deposit of this type is expensive and often financially prohibitive. The property has earned \$800,000. The present known ore reserve of the mine is estimated at \$1,000,000 net. This figure is deduced by taking all the ore down to workable two-sided ore. This aggregate is then subjected to a process of elimination in order to arrive at a

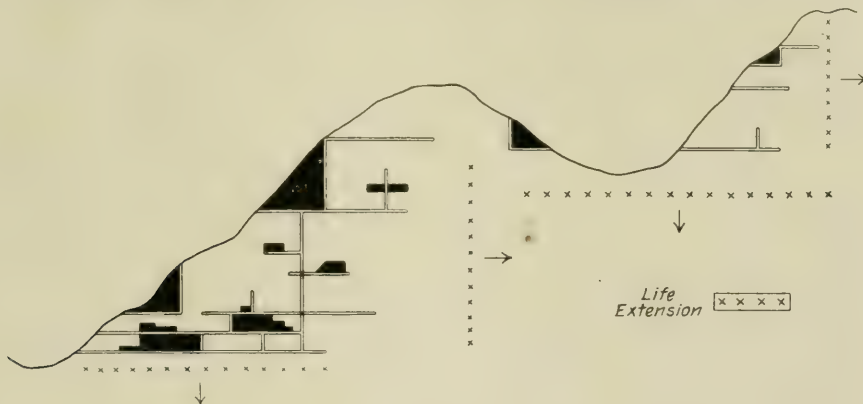


Fig. 2.

be belongs.' He would feel the confidence derived from constant encounter with new conditions governing the B value.

No. 1 represents a famous producer. It is a mine that has an active stock-exchange demand. To meet the requirements of a large list of shareholders, the administration has preserved the policy of maintaining an ore reserve averaging three to four years ahead of the immediate necessities of the mill. Dividends aggregating \$3,000,000 have been paid. At the last annual meeting, the shareholders were informed that the present net profit in the ore reserve was estimated at \$2,500,000. Four-fifths of this estimate was composed of ore developed on at least three sides. Life-extension was given as normal, the ore of the lowest level being similar to the preceding two above.

No. 2 represents a mine of radically different characteristics. The property is owned

net figure that can be relied upon until the present faces are further developed and additional faces exposed. The result is as presented. This procedure will be understood by those familiar with this type of metasomatic deposit. As a sequence to such a development programme, when the data were compiled the mine could only show \$300,000 net in four-sided ore.

Comparing them in further detail, it is seen that the uniform production of No. 1 has been phenomenal. In the light of past experience in depth, a not unusual risk would be contracted in anticipating similar extension for three succeeding levels. This would be 300 ft. Each succeeding zone is, however, drawing proportionately nearer the horizon where ore-shoots will eventually terminate. Two other levels may reveal similar tooth-shaped barren lenses as exhibited in subsequent development below A B in mine No. 3. This

last presents the reverse condition. Instead of being dependent on the extension of a bottom that is now down to a depth of 1750 ft., it possesses not only two bottoms, but also two sides. The latter will advance through comparatively superficial zones where the recognized enriching effects of secondary alteration are most prevalent. Assuming equality in general economic conditions, this will permit a working cost with which the deep-level conditions of No. 1 could not compete. Grade for grade, No. 2 will be more profitable, and ore zones will yield a profit that in No. 1 could not be treated.

No. 3 represents the frequent condition of a simultaneous curtailment of orebodies in depth at an epoch when ore reserves are greatest. An operator who has been brought up to figure on the security of a large ore reserve would get a severe 'jolt' when subsequently exploring below the line A B. After such an experience he will realize that there is little dependence between ore reserves and the life-extension of a mine. Ore reserves are largely a matter of administrative policy. He will realize that it is illogical to vitiate the consideration of the B value by introducing a transient factor of the ore enclosed within development extremities. Yet it would be a safe bet to say that if he had examined No. 2 previous to the experience below A B, he would consider his own mine the better. He would be especially confident in this opinion had he directed its steady growth down to the thirteenth level.

I have gone into this somewhat lengthy discussion with the object of showing how unlike these properties are, and not with the intention of tabulating dissimilarities that would hoodwink the manager of one mine if sent to report on another. Many of the dissimilarities are obvious. The manager of No. 1, accustomed to operate a property possessing well defined walls and uniform ore-values, permitting long lengths of uninterrupted stoping with a minimum of dead work, will find that he has to consider entirely foreign conditions in the case of No. 2. In the latter property development is conducted along a fracture-plane in andesite that is difficult to follow when not driving in an ore-shoot. The ore-shoots of No. 2 are important when encountered, and of considerable width, but their limitations cannot be largely defined by ocular observation, as in the case of No. 1, but by assay. The B value, or future possibilities of No. 2, is not based on the contemplation of a definite structure as in No. 1, but on recurring ore-shoots

along a zone of secondary enrichment.

While it is true that I have met mine managers who are skilled in the early appraisal of deposits, I might point out what I believe to be one of the underlying causes of many failures in mining. When work is started on a 'prospect' that is sufficiently explored to justify further work, it will then undergo the most critical phase of its career. Instead of employing a mine-valuer of standing to lay out the early development, with the idea of establishing evidence of future worth, or to simultaneously cut a loss as soon as possible, an underpaid mine manager is employed. In his unskilled attempt to emulate work that should have been designed by a specialist, he bumbles in doing unimportant development. Finally the property either breaks or disheartens the 'penny-wise' owner, who thought to economize by employing a cheap man because there were no incoming funds. If a specialist is then employed, he will in all probability find that he could have disclosed more data on infinitely less development footage, or have long since cut a loss. At the start his fee would only represent a small premium to insure the laying out of efficient work that could be carried on by a moderate priced manager. The fee expense would subsequently be many times returned by the elimination of useless work.

It is clear that I endorse a plea for greater specializing in the various branches of the art of mining. In such a wide subject specialization can alone produce the best results. A specialist in one sphere when attempting work in another can only make a lame effort to meet the requirements of the case. The valuer and the mine manager are equally important to the industry; but the shrewd mine-owner who has profited by experience will employ them in their respective functions.

The Iridium used for making points for gold pens is prepared from the slime left in the wet process of platinum refining. It is not possible to melt the powder obtained by drying this slime, and thus to obtain a coherent mass of the metal. The method pursued is to heat it in a crucible and add phosphorus, the result being the production of iridium phosphide, which readily melts. This is afterwards heated with lime, which removes the phosphorus, leaving a brittle white mass of iridium. This cannot be filed or cut with ordinary tools, but it can be broken into small pieces, which are ground by carborundum to the shapes required.

PRECIS OF TECHNOLOGY

Rare Metals in Blister Copper.—The June *Bulletin* of the American Institute of Mining Engineers contains a paper by Anton Eilers recounting the recovery of rare metals from blister copper at American and other refineries. Particulars are given of the yield at Garfield, Steptoe, Omaha, Mountain Copper, and Tacoma, in the United States, Aguascalientes in Mexico, Cerro de Pasco in Peru, and Mount Lyell in Tasmania; the metals recovered comprise gold, silver, platinum, palladium, selenium, tellurium, bismuth, and nickel. At Garfield the blister copper comes chiefly from the Bingham porphyry copper mines, and at Steptoe from the Nevada Consolidated porphyry mines. At Omaha the blister comes principally from concentrated copper-lead mattes shipped from the silver-lead plants of the Rocky Mountain region to the converters at the Omaha lead refinery. The Tacoma ores come from Alaska, and are all associated with diorite. The blister at Aguascalientes is produced from the smelting of gold and silver ores with low-grade copper ores, coming from all parts of Mexico

magnesite brick. He gave up the idea on account of the cost of linings and because no particular advantage was observed. Mr. Mathewson's belief is that Mr. Keller's tuyeres and converters were too small. A short time afterward similar experiments were tried at the Great Falls plant of the Boston & Montana Co., and at the old works of the Anaconda Copper Mining Co., in Anaconda. These were abandoned on the score of cost and the lack of advantages. The same cause of failure, in Mr. Mathewson's opinion, holds here. The Anaconda Copper Mining Co., however, adopted the magnesite brick lining for its tilting casting machines. E. A. C. Smith, while temporarily in charge of these casting machines, tried the experiment of blowing the copper in the casting machines, but the return of the head of the department put a stop to the experiment, and Mr. Smith put the idea away till a more favourable opportunity presented itself.

About 1903 Baggaley began his experiments of smelting ore in a basic-lined converter in Butte, Mont., at the Pittsmt smelter. He was followed by Knudsen at the Sulitjelma plant, in Norway, in 1907. About the year 1905 similar experiments were tried at

MONTHLY OUTPUTS OF BLISTER COPPER AND RARE METALS.

	Blister. Tons.	Gold. Oz.	Silver. Oz.	Platinum. Oz.	Palladium. Oz.	Selenium. lb.	Tellurium. lb.	Bismuth. lb.	Nickel. lb.
Garfield, Utah.....	5000	14,400	174,000	17'09	59'14	2800	277	305	2000
Per 100 tons blister		288	3,480	0'342	1'183	56	5'54	6'1	40
Steptoe, Nevada.....	3000	5,070	16,500	30'48	132'10	3303	None	10	1920
Per 100 tons blister		169	550	1'016	4'402	110		0'33	64
Omaha, Nebraska.....	800	2,880	184,720	14'60	51'89	213	537	151	7552
Per 100 tons blister		360	23,090	1'825	6'486	26	67'1	18'6	944
Mountain Copper, California	150	2,127	16,485	1'98	0'91	54	5	41	172
Per 100 tons blister		1,418	10,990	1'320	0'607	36	3'3	27'3	111
Tacoma, Washington.....	800	17,496	69,680	5'68	26'62	336	None	46	6160
Per 100 tons blister		2,187	8,710	0'710	3'327	42		5'7	770
Aguascalientes, Mexico.....	1100	5,302	740,300	4'58	2'49	1870	None	44	132
Per 100 tons blister		482	67,300	0'416	0'226	170		4'0	12
Cerro de Pasco, Peru.....	2000	3,400	198,000	6'38	11'77	275	None	270	640
Per 100 tons blister		170	9,900	0'319	0'589	13		13'5	32
Mt. Lyell, Tasmania.....	800	3,716	57,640	4'99	10'99	336	None	34	1328
Per 100 tons blister		464	7,205	0'624	1'374	42		4'3	166

and from many different geological occurrences. The Cerro de Pasco ore comes from veins occurring in limestone near andesite masses. No doubt the metals recovered are only a portion of the contents of the ores. Some of the rare metals are marketed, but as a rule they are not easily sold.

Basic-Lined Converters.—The June *Bulletin* of the American Institute of Mining Engineers contains a paper by E. P. Mathewson on the history of the basic-lined converter, as applied to the treatment of copper mattes

In discussing a paper on 'The Basic Process as Applied to Copper Smelting,' by Percy C. Gilchrist, read before the Society of Chemical Industry on January 5, 1891, W. C. Roberts-Austen asked Mr. Gilchrist whether he thought that the substitution of a basic lining for acid lining in the Manhès process would afford anything like the service which it had been shown to render in the metallurgy of iron. Claude Vautin stated that he had experimented for over two years with basic linings for bessemer converters for copper mattes at Cobar, but had given up the attempt on the score of cost. Mr. Gilchrist in his reply stated that he did not believe in applying any system of bessemerizing to copper. About the time of the presentation of the paper mentioned, H. A. Keller, superintendent of the Parrott smelter, in Butte, was experimenting on a large scale with converters lined with

several smelters, notably the plant of the United States Smelting Co., at Midvale, Utah. Mr. Smith, who was then with the Baltimore Copper Co., found his opportunity to experiment, and his superintendent and manager, Mr. Peirce, gave him all the help in his power, the result being the construction at Baltimore of a basic-lined converter for leady copper mattes, along the lines of the old tilting anode furnaces of Anaconda. The experiment gave promising results, so the American Smelting & Refining Co. took up the process and introduced it with success on leady copper mattes at its lead refineries at Perth Amboy and Omaha. Then Smith and Peirce persuaded the company to try it on straight copper mattes at the Garfield, Utah, plant.

In the meantime the Anaconda Copper Mining Co., at the Washoe Reduction Works, Anaconda, lined a shell of the standard trough pattern with magnesite brick. The results were excellent, so they gradually replaced all the acid lining with magnesite brick. At Great Falls the same company's experts developed a large converter along the lines of the upright shell, and, as this type is easier to build and keep in repair, it has become the standard during the past year. Practically all the bessemerizing of copper mattes in the United States is now done in basic-lined converters. The main points to be observed for successful operation of the basic linings are: not to exceed a

temperature of 2,100° F.; not to have tuyeres smaller than 1' 25 in. (1' 5 in. is the preferred size); to drive in punch rods the full size of the tuyere opening, immediately after pouring copper; to maintain in the converter as large a mass of matte and slag as possible to prevent sudden changes in temperature and overheating of the lining; to employ slag containing preferably about 25% of silica.

To Smith and Peirce belongs the credit of taking a long-discarded idea and developing it into a successful process. The great advantages of the process are: decreased cost of lining; the ability to use large units in converting, with consequent economies in labour, power, and repairs; neatness and cleanliness of plant, abolishing the danger, from dust, to the health of the lining crew.

Schmidt & DeGraz Dezinking Process.—The *Australian Mining Standard* for June 12 contains a report by P. S. Morse on dezinking processes in operation in Germany. The investigations were made with the object of finding a process applicable for extracting zinc from the slag produced at the Hercules lead-zinc-silver mine in Tasmania. Mr. Morse inspected the Pape process in use at Oker, and the Schmidt & DeGraz process at the works of the Rhein-Nassau company, Stolberg. He also obtained information about Savelsberg's new process, but was not allowed to inspect the plant owing to the patents not having yet been granted. In the Pape process the crushed slag is briquetted with coke and treated in a blast-furnace. The zinc comes away as oxide, which is caught in a bag-house. In the Schmidt & DeGraz process, the slag is treated in a molten condition in a reverberatory furnace, after being mixed with anthracite or coke, and lime or limestone. The zinc is driven off as oxide by the reaction of the fluxes. Most of the lead in the slag and part of the silver are oxidized with the zinc and collected in the oxide. If cold slag is to be treated, it must first be melted and delivered in a molten condition to the reverberatory. The oxide is caught in a bag-house, but before its arrival there, the oxide and gases from the reverberatory are passed through boilers. The power so produced is sufficient for the requirements of the process. At first the melting and dezinking were done in separate reverberatories, but it has since been found that the operations can be conducted in one furnace. The director of the Rhein-Nassau company gave Mr. Morse access to the records. From these it appears that slag varying from 7 to 11% zinc can be treated profitably. The slag after treatment contained from 1½ to 2½% zinc. The cost in Germany of a complete plant to treat 50 tons per day was given as £9500. In Tasmania the cost would be from £15,000 to £20,000.

Mill-Sites.—The *Mining and Scientific Press* for July 5 contains an article by Herbert Lang on the design and building of metallurgical plant. The article should be read in conjunction with Gelasio Caetani's articles on similar subjects that have recently appeared in the *Mining and Scientific Press* and *The Mining Magazine*. Mr. Lang's remarks on the relative advantages of level and hill-side sites are of special interest and we quote them in detail.

Little is gained in general by extensive excavation, especially if it be in hard ground, since the improved methods of elevating and transporting render it in a measure unnecessary. The ideal metallurgical works should be so arranged that all parts may be accessible by a broad-gauge railway line. This necessitates laying-out the plant by the side of the tracks, with the longer axis of the buildings parallel to the rails, and not transverse, whereby the greatest convenience in

the matter of dumping room is secured. The plant, if at all extensive or complicated, should be divided into departments or sections, so as to have good ventilation with freedom of each section from the smoke, gases, and flying particles from the others. By this disposition, the cost of buildings, and particularly of grading and of retaining walls, may be much diminished. Where, on the contrary, the different parts of a plant are huddled together, not only is the cost of working greater, but that of subsequent additions to the works will also be greater. Further, the very compactness of a plant, which is so much valued by some designers, will invariably prevent the orderly and logical additions of parts that may be subsequently found necessary.

Most metallurgical works are built upon hill-sides in order to get the benefit of gravitation, by which the substances undergoing treatment are assisted on their way. The practice of so building the works has become fixed by the habit of generations, and with some builders has become almost second nature. But with the improvement in machinery, by which a wealth of appliances for hoisting, transferring, and lowering the heavy and bulky materials of metallurgy is now available, the arguments and reasons that formerly led to the hill-side have mostly lost their force, and a rival school, advocating the so-called level site, has appeared. Their arguments relate chiefly to smelting, but have an important bearing upon other metallurgical processes.

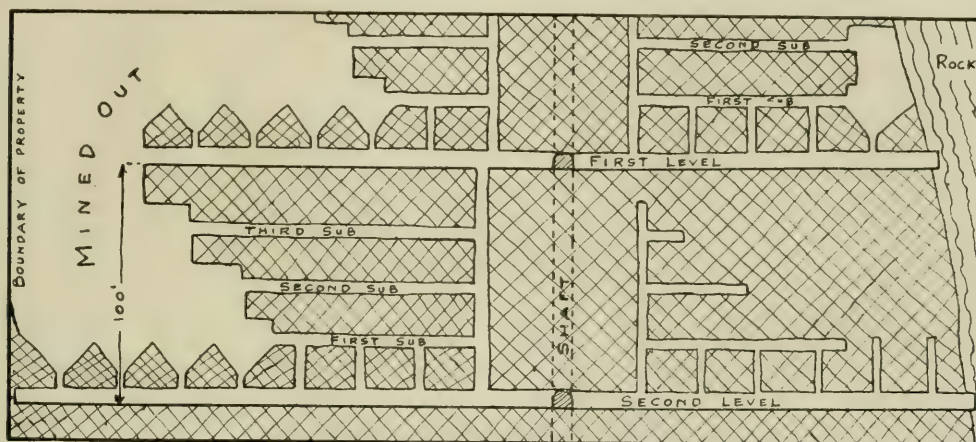
A sloping or hill-side site is made up virtually of a number of terraces, upon each of which some part of the plant is placed; there may be two, three, or more of these terraces, the result of excavation into the hill-side. The single-level site, which ostensibly is composed of but one level, virtually has quite as many, if by 'level' is meant the elevation on which work is performed. For there must be, first, a lower dumping ground on which the waste is deposited, and also several floors of greater or less extent, upon which the men stand to work at their tasks. Each of these floors may be entitled 'levels' with as much propriety as if they were the generally more extensive areas embraced in the hill-side site. Thus there must be a space about the head as well as the base of cupola furnaces for their proper working; the use of ore-bins implies at least two levels; and so for the usual arrangements of metallurgical works of all kinds. The conflict of opinion as regards one-level versus terraced sites was largely based upon a misapprehension, and there is really not such a great difference between the two opposed plans of construction as has been generally imagined. The greater differences arise from the method of supporting the levels and their relative positions about the works. In the hill-side plan they are laid out in an orderly sequence from top to bottom; while in the one-level plan they are scattered about the terrace according to convenience or the views of the designer. In the former they rest upon the solid or filled ground; in the other they are supported, for the most part, on framework of wood or metal. The question, therefore, is narrowed to a consideration of the relative advantages of floors or levels supported by posts, or by earth or stonework. It is necessary to consider the matter of installing and using the different classes of elevating and transferring machinery made advisable by the one or the other plan, together with the possibility of future enlargements and alterations—a matter that should always be kept in mind.

There is no question that the one-level site, with buildings somewhat widely separated, is the most

favourable to enlargements; and while the question of convenience and economy of working is to be settled by the engineer on the spot, Mr. Lang is convinced of the superior advantages of the one-level plant in those respects also. Doubtless, most builders will agree that ventilation is better, and that as a general thing the danger from the spread of fire is less. As a rule, there is greater economy of space in the one-level plan, as the room directly beneath the upper floors is not wholly occupied by the supports, and because the stowage spaces can be better utilized. Ore, for example, which it would be out of the question to transfer for storage from one level to another, may be moved on the same level to wherever convenience may dictate. Thus any given space on the terrace may be used successively for several purposes, while on the hill-side plan the engineer is rigidly held to one use for one space.

In the case of stamp-milling, where the course of the ore is constantly downward, and where there are no materials of any moment that require to be returned from lower to higher levels, there is little

about 25 ft. from floor to floor. The first sub-level, consisting usually of a single drift, intercepts the tops of the chute-rises. The sub-level drifts are hastily driven and do not resemble the carefully trimmed haulage drifts. Stopping is started on the first sub-level by putting in down-holes around the end chute-rise for blasting out a funnel shaped top, 'uppers' being blasted next. The right-hand portion of the first level shown in the accompanying figure illustrates the starting of a stope, and below on the second level is shown an earlier stage of development with sub-levels partly driven. The second level on the left-hand side shows a stope well started, while above on the first level the stope is well advanced and the floor pillar is being mined and is falling into the second-level chute-rises, thus connecting the first-level stope with the second-level stope. As the sub-levels are drawn back toward the shaft or toward the ladder-way, both 'down' and 'upper' holes are used, as well as horizontal holes for widening to the walls. The walls should be firm so as not to cave and mix with the broken ore. The miners take care to keep the bottom



SUB-LEVEL STOPPING METHOD IN MICHIGAN.

opportunity to argue against the hill-side construction. But in processes like cyanidation, where the re-elevation of the liquids forms an important part of the process, and which cannot be obviated, there is less reason for seeking a site upon sloping ground, as the pumping of the liquids from tank to tank cannot be much forwarded by differences of levels between the tanks.

Stopping in Michigan Mines.— In the *Mining and Scientific Press* for July 5, P. B. McDonald reviews several methods of mining iron ore deposits in Michigan. These lodes are comparatively wide and dip steeply. We reproduce herewith his description of a comparatively new sub-level stopping method that is in use in many of the smaller mines of the district, where the orebodies are up to 100 ft. in width. A vertical shaft is sunk in the foot-wall and a cross-cut is driven on each 100-ft. level to the ore, where a main haulage drift is driven in each direction, lengthwise of the deposit. If the orebody is wide, two parallel haulage drifts are sometimes driven and connected at intervals, making a convenient track system for motor haulage. Chute-rises are then driven 25 ft. above the floor and spaced 25 ft. centre to centre, being put in the cross-cuts if necessary. Main haulage levels are usually 100 ft. apart; and three sub-levels are driven, spaced

sub-level back under the middle sub, and the middle sub-level farther back than the upper sub-level, so that they are protected by the unbroken ore over their heads from falls of ground in the stopes. The sub-level stopping method of mining is notably a safe one, as the miners attack the ore in the stopes taken from the sub-levels where they are practically as safe as in the main haulage ways. The chute-rises are equipped on the haulage levels with ordinary wooden lip chutes for loading tram-cars; by raising the planks from the mouth of a chute the ore runs out, but occasionally blocks itself from some large chunk becoming wedged, in which case a stick of dynamite may be necessary to loosen the ore.

When the orebody is wider, the mining of the ore in the sub-levels is accomplished by maintaining a bench to the wall on each, side which gives the miners a place to stand; the middle portion of the ore (where the sub-level drift is) is kept drawn back ahead of the sides, giving a semi-circular effect to the edge of the stope. In some cases where the sub-levels are rather far apart vertically, all the ore between cannot be reached either by the uppers from below or by one set of down holes from above; it is then necessary to climb down from the upper sub-level to the bench remaining, when the first set of down holes was blasted,

and drill another set of down holes. Should the ore be too soft to permit this bench to hold a man and a rock-drill, it would be necessary to space the subs nearer together and have more of them. The expense of driving the sub-levels is one of the disadvantages of the method. Where the orebody is long, it is customary to make the stopes about 250 ft. in length, separating them by ladder-ways protected by vertical pillars. It will be noted that this method of mining is an open stope method, in that the stopes are not filled with broken ore, waste, or caved material. The method has been adopted by mines that in the old days would probably have used the square-set timber method, and is sometimes preferred to the method of back stoping on broken ore.

Microscopy for Mining Engineers.—In the June *Bulletin* of the American Institute of Mining Engineers, F. W. Apgar contributes a paper entitled 'The Use of the Microscope in Mining Engineering.' Coming so soon after the publication of Graton & Murdock's classical paper, in which they proved the value of microscopical study in connection with the primary and secondary nature of ores, Mr. Apgar's exposition should find a receptive audience. He urges the desirability of microscopical study in connection with lodes and country rock, and as a means of investigating the best methods of concentration and metallurgical treatment of ores. After showing the advantages to be gained in determining the genetic history of ore deposits, he proceeds to indicate how a similar study can help in directing ordinary mining operations. The structural geology of the district and of the mine are important factors in determining the most economical system of stoping, the best positions for shafts and drifts, and the distance between levels. These factors are best determined by a careful survey of accessible workings, and the compilation of accurate mine maps showing all the geological features. For instance, a dike, fault, or orebody may be plotted, and correlated through similarity of microscopic characteristics with another exposure on a different level. Its strike and dip can then be computed, and its probable position at any specified point determined. With this information the miner is enabled to reach the particular formation with the least possible excavation, or to avoid it if so desired.

Mr. Apgar recounts a case in point relating to the identity of certain formations in the Eureka district of Nevada, and to the definition of the term 'vein' and 'lode' as used in the United States mining statutes. On a body of mineralized limestone at Ruby Hill, mining operations had been conducted for some time, when a dispute arose. One company, which had followed downward a more or less connected vein within the limestone, claimed ownership of a certain mass of ore on the 5th level, by virtue of the law of extra-lateral rights. The other company contended that the limestone itself was a lode as defined by the statute, and therefore that they were entitled to that portion of the ore situated on their side of a compromise line between the two claims. During litigation it was ascertained that a definite foot-wall of quartzite formed one boundary of the mineralized zone and that a shale and limestone formed a definite hanging wall. The rock included between the two differed in its characteristics from all other limestone in the neighbourhood. It was extensively altered, crushed, brecciated, and re-cemented by calcareous matter and silver-lead minerals; no traces of stratification remained. Microscopical methods thus helped to establish the fact that the mineralized Prospect Mountain limestone itself constituted a lode or vein of ore in place.

Mr. Apgar quotes another case. In determining the nature of a mineral occurrence in southern Arizona, a microscopic investigation was made of the ore and of some of the adjacent rocks. One of the latter proved to be a diorite, of normal appearance at first sight. But on closer examination it was discovered that throughout the rock there were some unusual opaque white crystals, perfectly developed, and generally surrounded by magnetite. These were identified as native silver. An assay of the rock, after careful sampling, gave an average silver content of 7½ oz. per ton. This silver might easily have been overlooked, had it not been for its accidental discovery in the thin sections.

As regards the value of microscopical study in determining the best method of treating an ore, the important points to ascertain are connected with the texture of the ore, the nature of the mineral aggregate, and the size of grain. Mr. Apgar quotes the recent case of the milling problem at a Canadian gold mine. Upon microscopical examination of the ore, it was found that most of the gold was closely associated with pyrite, as an inclusion or intergrowth, in a finely divided state. An appreciable proportion, however, occurred in the quartz gangue, separate from the other minerals. It was justifiable to anticipate that amalgamation would recover most of the latter gold, but would be ineffective on the other gold without extremely fine grinding. Hence a combination with the cyanide method suggested itself as a solution of the problem, and actual mill tests proved the value of these observations. He also quotes the case of disseminated iron in schists and gneisses, a class of ore now coming into prominence. Their importance lies entirely on the ease of magnetic concentration. If instead of normal magnetite, part of the iron is in the form of martite, which is only slightly magnetic yet resembles magnetite closely in general appearance, the ore might not prove profitable. Polished sections studied under vertical illumination would reveal the true mineral character, and the difficulty in the way of magnetic concentration would be immediately suggested.

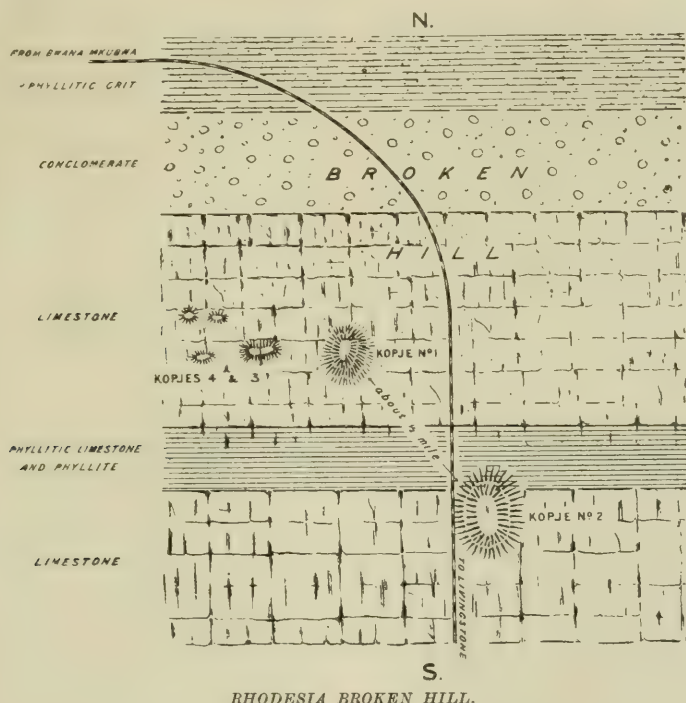
One recent development in the preparation of ores for metallurgical treatment, namely, the sintering of fine concentrate, flue-dust, etc., is worthy of notice in this connection. Many devices have been invented to accomplish this result, and when comparing the qualities of the sintered products from the various processes and determining the most appropriate treatment for a certain class of material, microscopical characteristics will be found of value in arriving at conclusions. For instance, it may be determined whether the material is sufficiently porous to permit the ready access of furnace gases, and whether the cohesiveness of the product is due to the formation of refractory silicates that would retard the reducing action.

Rhodesia Broken Hill.—We have received from A. E. V. Zealley a reprint of his paper recently published in the *South African Journal of Science*, describing the geology of the zinc-lead deposits at Broken Hill, Northern Rhodesia. This district has so far proved unremunerative to the mining operator. Nevertheless the geology and mineralogy of the ore deposits is of considerable interest.

The country in which the deposits occur is flat. The deposits consist of a series of four 'kopjes' or hillocks, and are composed almost entirely of the oxidized compounds of lead, zinc, and iron. Such development as has been done consists of adits at several levels and in various directions, a few rises and winzes, some shafts on the kopjes and between them, and

open quarries. The accompanying map gives the geology of the surface. The strata are almost vertical, with an east to west strike. From south to north the sequence of the beds is: (1) limestone, (2) phyllite, passing into limestone (3) largely dolomitic, (4) conglomerate, (5) phyllitic grit. These rocks belong to an ancient schistose sedimentary group. No. 1 kopje, 50 ft. high, is on the dolomitic limestone, and the smaller kopjes, No. 3 and No. 4, are near it. Kopje No. 2 is half a mile to the southeast of No. 1, and is partly in the limestone (1) and the phyllitic limestone (3). The distribution of the minerals at No. 1 kopje is described in detail by Mr. Zealley. The sulphide zone below water-level, called zone No. 1, consists of hard crystalline limestone, fine-grained, dolomitic, and quartzose, usually much jointed, preva-

an inch or so wide. Very small quantities of pyrite and chalcopryrite are also found. Cerussite is the most plentiful mineral in zone No. 2 of No. 1 kopje, and is found in large crystal aggregates incrusting the cavities in the rock. It is not present in No. 2 kopje. Zinc carbonate is found in large mammillated masses in the phyllite and limestone of No. 2 kopje, and it occurs also as incrustations in the cavities of No. 1 and No. 2 kopje. Silicate of zinc is plentiful in the cavities in No. 1 kopje. Many other minerals are found in smaller quantity, the most notable of which are the phosphates and vanadates of lead and zinc. These have been described by L. J. Spencer in the *Mineralogical Magazine*. The caves and the animal remains have been described by Franklin White, F. P. Mennell, and E. C. Chubb.



RHODESIA BROKEN HILL.

lently grey in colour, and containing scattered patches, particles, and small veins of zinc blende, galena, and a little pyrite. The water-level is only 17 ft. below the surface of the adjoining country. Zone No. 2 is the oxidized portion above the water-level to the top of the kopje, and is subdivided into zone 2a, the lower portion nearest the water-level. The zone consists of a highly ferruginized and silicified limestone, rotted and cavernous. It is strongly impregnated with carbonate of lead, carbonate of zinc, silicate of zinc, and other oxidized zinc and lead minerals. Small patches of unaltered crystalline limestone remain in this pale brown rock. The lower part, 2a, is the phosphate-vanadate zone. Presumably the pre-existent carbonates of zinc and lead have reacted with phosphoric acid supplied by extensive deposits of pre-historic animal remains found throughout the caves. The blende and galena below the water-level occur in small but frequent disseminations and veinlets in the limestone. These veins are generally not more than

Kalgoorlie Gold.—In our 'Book Reviews' this month we note the publication of E. S. Simpson and C. G. Gibson's bulletin on the geology and ore deposits of Kalgoorlie, published by the Geological Survey of West Australia. In our issues of July and August 1910, we abstracted Mr. Gibson's preliminary statement relating to the geology and ore deposits of the district, and in our issue of December 1912, we gave a summary of the paper by J. A. Thomson on the tellurides of Kalgoorlie. We proceed now to give Mr. Simpson's description of the methods of occurrence of uncombined gold at Kalgoorlie, contained in the bulletin above mentioned. The free gold contains more or less silver and traces of copper. It formed the sole source of the metal extracted from the oxidized zones of all the lodes and veins, and its occurrence in the unoxidized ores has been recorded at practically every mine of the district. Though tellurides have formed so important a feature of this district, it is probable that fully half of the gold recovered has

been in the free state. The shape and size of the particles are very variable, the coarse being amenable to amalgamation and the small and filmy to cyanidation. The following varieties have been recognized: (A) Crystallized: (1) coarse crystals, (2) fine isolated crystals, (3) sponge gold, (4) mustard gold, (5) dendritic gold; (B) not crystallized: (6) rough gold, (7) flake gold, (8) paint gold or float gold. Crystallized gold is less common than non-crystallized, and group (6) contains the largest proportion of the gold. As regards origin, (1), (2), and (7) are probably invariably primary; (2), (3), and (4) are invariably secondary, formed by the action of circulating ground-water in the oxidized and oxidizing zones; (5) and (8) may be either primary or secondary, being in both oxidized and unoxidized ores.

Coarse crystals (1) are extremely rare, and supposed specimens are usually found to have obtained their smooth faces from growing against faces of dolomite or siderite. Fine isolated crystals (2) are found on fracture or cleavage faces of oxidized ore. They are either single crystals from 0.05 to 0.1 mm. in size, or small hemispherical groups of crystals up to 1 mm. diameter. They are mostly in the form of imperfect octahedra, but occasionally the square faces of the cube are seen. Frequently the edges are well developed.

Excellent specimens of sponge gold (3) have been obtained in the Horse-Shoe and Great Boulder Proprietary mines. In the stopes above the 200-ft. level at the latter 70 lb. of pure sponge gold was extracted from a vug. It has also been found at the North Boulder mine. Sponge gold is undoubtedly the oxidation product of a telluride, probably calaverite. It is a porous mass of small incompletely-developed mutually-adherent gold crystals, with brilliant hue, growing in arborescent form, with a structure similar to a vegetable sponge or lufa. The individual crystals average 1 mm. in diameter, and are of complex form. An analysis showed 99.9% gold and 0.1% silver. The decomposition of calaverite would produce an alloy containing 98.4% gold and 1.6% silver, and as this decomposition was doubtless effected by the sulphuric acid obtained by the oxidation of pyrite, a large part of the silver would be removed at the same time as the tellurium, thus producing an unusually pure gold. A good imitation of sponge gold was made artificially by dissolving calaverite in aqua regia, then removing almost all the nitric acid, and finally slowly precipitating the gold by oxalic acid.

Mustard gold (4) is similar in structure to sponge gold, but without crystalline form; its colour is that of clayey or of dull yellow ochre. It is more compact, but at the same time more easily broken into fragments than sponge gold. Characteristic specimens have been obtained at the Lake View Consols and the Kalgurli mines. It is found loosely filling irregular pockets in oxidized ore, being doubtless the result of oxidation of tellurides previously completely filling the pockets. It can be obtained artificially by slowly dissolving a piece of telluride in sulphuric acid; the tellurium is leached out, and the gold is left in exactly similar form to mustard gold.

Thin plates of gold showing a dendritic structure (5) due to partial development of crystal faces occur occasionally on joint planes in oxidized ore. A good specimen came from the Ivanhoe.

The rough gold (6) is irregular in boundary, with no crystal faces, and no dimension markedly greater than another. Wire gold is never found at Kalgoorlie. The rough gold is found in all sizes from microscopic specks to fair-sized slugs. It is internally of crystalline

structure, but its exterior is rough owing to the fact that in process of growth it has come in contact on all sides with hard and insoluble minerals. When the gold has been deposited simultaneously with coloradoite, the surfaces of the gold are often smooth and curved. Flake gold (7) has been found in many mines in cracks in quartz and other minerals, and in both oxidized and unoxidized zones. It varies from 0.1 to 1 mm. in thickness, and as it sinks in water it is readily caught in the battery. Paint gold (8) is the most difficult form from the metallurgical point of view. It consists of films 0.01 mm. thick or less, or even as thin as gold-leaf. Often the films are no bigger than scale, from 1 to 3 mm. wide. It is found in both oxidized and unoxidized ore, in narrow cracks or cleavage planes, intergrown with sericite and chlorite, between which it appears to have been deposited. It should be added that these eight classes of gold merge into each other without any hard and fast boundaries from their fellows.

Early History of Kalgoorlie.—In the *Mining and Scientific Press* for July 12 a series of articles on the 'Geology of the Kalgoorlie Goldfield,' by Malcolm Maclaren and J. Allan Thomson is commenced. We have noted in another précis in this issue the memoirs on this subject by Larcombe and by Simpson & Gibson. Mr. Maclaren undertook the investigation of the Kalgoorlie orebodies on behalf of a group of companies under the management of Bewick, Moreing & Co., at the time when H. C. Hoover was a member of the firm, and the expense was borne by the Ivanhoe, Oroya Brownhill, and Lake View Consols companies. It is appropriate here to reproduce part of the early history of Kalgoorlie gold mining before the discovery of tellurides. In our issue of July 1912, Mr. Maclaren gave the history of the identification of tellurides at Kalgoorlie, and we need not now reproduce his account.

The discovery of gold at Kalgoorlie may be regarded as an indirect result of the impetus given to prospecting in Western Australia by the finding of gold at Kimberley in 1886, and at Yilgarn (Southern Cross) a year later. Western Australia had previously been considered a country barren in gold, an illusion shaken by these discoveries and completely shattered by later reports, in rapid succession, of gold from Pilbara, Ashburton, and Murchison. Encouraged by these discoveries, prospectors pushed eastward into the dry inland plains. Previously this part of the State had been known only to explorers, of whom the principal were Lefroy (1863), Hunt (1864), Forrest (1871), Giles (1875), and Lindsay (1891). Their attention was directed rather to the pastoral than to the mineral resources of the country. Hunt settled on the areas now held by the Hampton Plains Co. in the vicinity of the goldfields. He dug wells to fit the areas selected for occupation by cattle, so had more opportunity than other explorers for examination of the rocks. He noted numerous quartz outcrops, and it was perhaps the rumour of these that determined several prospectors to examine the country lying east of Southern Cross. Favoured with good rains, two, Bayley and Ford, pushed eastward in June 1892, across the great granite belt, following the track of Hunt's wagon wheels, not wholly obliterated after 28 years of desert dust and storm. They rested at the Gnarlbine 'soak,' and then moved northeast to a 'gnamma' hole, known to the aborigines as Gulgarda, afterward to be softened by the digger to Coolgardie. Camping on what is now known as Fly Flat, they soon detected gold lying on the surface, Ford picking up a slug weighing half an ounce.

Western Australia is one of the few auriferous areas in the world in which direct support is given to the vulgar belief that gold nuggets lie on the surface for the picking up. After rains and before the winds have had time to obscure the washed surface with the light desert dust, grains and nuggets of gold are readily seen by the trained eye, a method of search known as 'specking.' Three or four weeks dry-blowing and specking had yielded to Ford and Bayley 200 oz. of gold, when they were forced to return to Southern Cross to replenish their supply of provisions. With the digger, shallow alluvial gold is merely the promise of great stores of vein gold, and the two prospectors on their return lost no time in examining the adjacent quartz outcrops. They were more fortunate than the majority of prospectors who have acted on this assumption, for a short search disclosed the cap of a rich gold-quartz vein, from which they had by the end of the day and with the aid of a hatchet and pestle and mortar obtained more than 500 oz. of gold. They had allowed no inkling of their first discovery to escape, and it was not until the application for a reward claim was safely lodged, on September 17, 1892, with the warden at Southern Cross, that the news of the great value of the discovery and of its locality was made public.

A steady inrush to the new Eldorado naturally took place, but its magnitude was at first limited by the difficulty of transport, by the high cost of provisions, and most of all, by the great scarcity of fresh water. When all available auriferous ground had been taken up at Coolgardie, prospectors spread out from that centre scouring the country for many miles in search of new fields. When the discovery was reported, a wild scramble took place to peg out in the neighbourhood of the original reward claim. In these 'rushes' every available means of transport was pressed into service, camels, horses, bicycles, carts, and even wheelbarrows being mingled with the throng that pressed forward on foot and carried their supplies on their backs. Most ended in disappointment, one or two in disaster. Kalgoorlie was discovered in 1893 and Londonderry, Black Flag, Kanowna (White Feather), and Bulong (I. O. U.) in 1894. By the end of 1895 more than 10,000 people were collected in the various camps.

Gold was discovered at Kalgoorlie on Saturday, June 17, 1893. The finders were Patrick Hannan, Thomas Flannagan, and Dan Shea, who were on their way from Coolgardie in response to a nebulous rumour of rich gold at Mt. Yule (perhaps Mt. Jewel, north-west of Kurnalpi). It proved an *ignis fatuus* in the end, and the three had camped for the night on the western side of a ridge 22 miles east-northeast of Coolgardie, near the site of the present Hannan street railway station. The first-named seized the opportunity afforded by the halt to search for gold in the neighbourhood of the camp and soon discovered ('specked' in local parlance) gold lying in small nuggets on the surface. All thought of the district of Mt. Yule was abandoned, and Hannan hastily returned to Coolgardie to secure a reward claim. The following day, Sunday, June 18, the whole available population flocked to the new Eldorado of 'Hannan's Patch,' as it was then called. The so-called 'alluvial' ground west and southwest of Cassidy hill and Maritana hill (Mt. Gladden) proved very rich for a time, and occasional large nuggets were obtained, none, however, weighing more than 24 oz. These are small in comparison with the famous nuggets of Victoria and New South Wales, but the climatic conditions obtaining in the interior of Western Australia preclude the accre-

tion of gold necessary for the growth on a large scale of alluvial gold. Other 'dry-blowing' areas were soon discovered, the principal being in the neighbourhood of Slug hill to the south of the present Boulder mines. So-called 'deep-leads' were also found both east and west of the main ridge, but the yield of surface gold was never important.

The lack of alluvial gold turned the attention of the diggers toward the possibility of discovering the lodes from which the surface gold was assumed to have been derived, and claims were pegged out in all directions, but mainly north and south along the Kalgoorlie ridge. Most of the miners on the new field had gained their experience in Victoria, New South Wales, Queensland, and New Zealand; it was therefore natural that the search for vein gold should be confined to quartz outcrops. These had furnished the gold of the neighbouring Coolgardie field and there was nothing to indicate that different conditions obtained at Kalgoorlie. It thus happened that the rich mines of the Boulder belt, two miles south of the original discovery, were pegged out on account of their worthless quartz veins. Capital from Adelaide and Melbourne was furnished to open up most of these mines, but development was for a long time exceedingly slow. It was known even then that the rich deposits of the outcrops of the majority of Western Australian lodes did not persist below the zone of oxidation; it was therefore feared that Kalgoorlie lodes would form no exception to the general rule, and there was, from market considerations, a rooted disinclination to pass into the sulphide zone lying at an average depth of 180 ft. beneath the surface. The Great Boulder mine led the way into this zone, and its success encouraged others to follow. The first real hope for the permanence of the field was, however, engendered by the discovery of tellurides of gold. As we mention at the beginning of this précis, Mr. Maclaren described the development of the telluride deposits in our issue of July 1912. We may also refer readers to the article in our issue of June 1912, by H. E. West, on 'Early Days at Kalgoorlie.'

CURRENT LITERATURE.

Mining Costs at Anaconda.—The July *Bulletin* of the American Institute of Mining Engineers contains a paper by H. T. Van Ells describing the method of segregating costs in the mine accounts of the Anaconda Copper Mining Company.

Microscope in Mineralogy.—In the *Columbia School of Mines Quarterly* for July, A. J. Moses describes his improved scheme for utilizing the polarizing microscope in the determination of minerals of non-metallic lustre.

Concentration Tests.—In the *Mining and Scientific Press* for July 12, A. T. Tyte describes the plant used by the Cananea Copper Co. for testing the efficiency of concentration as applied to varying ores. The testing plant contains standard-size machines.

Smelting at Great Altitudes.—In the *Columbia School of Mines Quarterly* for July, Vincente Pazos y Sacio gives the results of a scientific inquiry into the conditions of air-supply and heat generated in blast-furnaces at great altitudes, in special reference to the Cerro de Pasco plant.

Moore Filters at Waihi.—The May *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a lengthy and detailed paper by William Macdonald on the slime treatment plant at the Victoria mill of the Waihi Gold Mining Co. This plant was designed by H. P. Barry on the Moore system.

Spaulding's Agitation Method.—In the *Mining and Scientific Press* for June 21, C. F. Spaulding makes further suggestions with regard to the operation of his process for continuous agitation with barren cyanide solution, described in the issue of March 1, and in this Magazine for April.

Precipitation of Silver from Cyanide Solutions by Aluminium.—In the *Engineering and Mining Journal* for June 28, S. F. Kirkpatrick describes the application of aluminium dust for precipitating silver from cyanide solutions, adopted at the Deloro works in connection with the treatment of silver ores from Cobalt. This paper forms an addendum to E. M. Hamilton's article, which was abstracted in our June issue.

Mother Lode of California.—In the *Mining and Scientific Press* for June 21, J. H. G. Wolf commences a series of articles on the Mother Lode of California. The re-opening of the Plymouth mine by Bewick, Moreing & Co. has revived interest in this mining region among English engineers.

Algerian Iron Ore.—*The Iron & Coal Trades Review* for July 18 and 25 contains a description of the iron ore mines at Rouina, Algiers, worked by a Belgian company. The ore is mostly shipped to the north of England.

Queensland Coal.—*The Queensland Government Mining Journal* for June contains a report by B. Dunstan on the coal resources of Queensland.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

Ore Deposits. By S. F. Emmons. Cloth or half-leather, octavo, 950 pages, illustrated. New York: American Institute of Mining Engineers. Price 21s. and 25s. For sale at the Technical Bookshop of *The Mining Magazine*.

The sub-title states that this book is a sequel to the Posepny volume on the genesis of ore deposits and that it is a compilation of contributions on this particular subject from the Transactions of the Institute. A preface by Dr. R. W. Raymond indicates the fact that the Secretary Emeritus aided the nominal compiler and editor of this volume. It is credited to Emmons, who died over two years ago, but not before he had written the introductory chapter. A biographical notice by Mr. George F. Becker, his friend and colleague, constitutes an appropriate supplement to that introductory chapter, and a carefully prepared bibliography of the subject generally by Mr. John D. Irving, a junior friend and colleague of Emmons, serves as a useful appendix. Between these comes a series of articles republished mainly, but not entirely, from the Transactions of the Institute, and constituting together a suitable sequel to the Posepny volume. In selecting the papers for this book, it was found necessary to omit those that were descriptive rather than genetic in treatment, in order to find room for those more particularly devoted to the hypothetical part of the subject. Of the 950 pages, only 137 were written by Emmons himself, but it is not too much to say that the impress of his work and thought lies heavily on the writings of all the other men, and especially those of his juniors who worked with him on the U. S. Geological Survey or met him as mining engineers in the field. For ourselves, we regret that this Emmons book was not composed entirely of a selection

from his own writings, of which there are enough to fill several volumes, but we can quite understand how his characteristic modesty caused him to acquiesce gladly in the plan formulated by the distinguished secretary-editor of the Institute. To Dr. Raymond the geology of mining is deeply indebted not only for this publication but for his lifelong effort to promote and stimulate the dissemination of knowledge on the occurrence and discovery of ores.

The early papers by Emmons, notably those published in this volume, are deeply interesting at this date, as showing the growth of accepted theory. It has always been our opinion that the 'Structural Relations of Ore Deposits,' published in 1888, constitutes one of the finest and most immediately useful papers ever written on mining geology. It is quite in line with Emmons' splendid work at Leadville, where he proved once and for all that the application of geology to mining has an economic value that can be measured in millions of dollars. 'The Torsional Theory of Joints,' by George F. Becker, is a paper well worthy of preservation in the reference library of the profession, so is that of R. A. F. Penrose on 'The Superficial Alteration of Ore Deposits.' Indeed, we have long suspected that this article, first appearing in *The Journal of Geology* in 1894, instigated and stimulated the far-reaching studies of Emmons, Weed, and others on secondary enrichment.

Another paper that impressed current scientific thought was that of J. E. Spurr, on the segregation of igneous rocks as affecting the distribution of ore. It was in this paper that he introduced the term 'metalliferous province' and explained how magmatic segregation leads to the concentration of the metals. In a later paper on Western Nevada he developed these views, and applied them to the ore deposits of a region to which he had given detailed and economically successful study. He advocates the theory that mineralization is due to the residual solutions and gases resulting from the consolidation of igneous magmas, this process predominating over the action of ordinary circulating ground-water. It may be that Mr. Spurr has gone ahead faster than his supporters, but it cannot be denied that his writings have impressed profoundly the development of theory. This, of course, is particularly true of Waldemar Lindgren and James F. Kemp; the former being represented in this volume by his paper on the copper deposits of Clifton-Morenci, 'The Occurrence of Stibnite at Steamboat Springs,' and 'The Geological Features of the Gold Production of North America.' These are all interesting and valuable, but they are not among this author's most important contributions. Kemp has a characteristic paper in 'The Copper Deposits at San Jose, Tamalipas, Mexico,' in which he traces the effects of contact metamorphism. He has another paper in line with his teaching entitled 'Igneous Rocks and Circulating Waters as Factors in Ore-Deposition.' This is a sequel to 'The Role of the Igneous Rocks in the Formation of Veins,' appearing in the Posepny volume. Taken together, the two papers last mentioned have exercised a marked influence on economic geology, and mining engineers will do well to "read, mark, learn, and inwardly digest" them. W. H. Weed is well represented by the 'Influence of Country-Rock in Mineral Veins,' 'Ore-Deposits near Igneous Contacts,' and 'Ore-deposition and Vein-Enrichment by Ascending Hot Waters.' The contributions by John R. Don and George J. Bancroft enrich the volume, which ends with the recent and highly suggestive paper by W. H. Emmons on the agency of manganese in secondary enrichment. A short summary of cognate

papers suggests how much good material has to be omitted, and when we recall the many important articles appearing in the *Engineering and Mining Journal* and the *Mining and Scientific Press* during the last decade, we realize the enormous mass of material relating to the subject. However, this volume is a successful effort to compile some of the best of it. It is also a proper but inadequate tribute to the work done by a great economic geologist.

T.A.R.

Practical Stone Quarrying. By Allan Greenwell and J. Vincent Elsdon. Cloth, octavo, 564 pages, with many illustrations. London: Crosby Lockwood & Son. Price 12s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is the most complete book dealing with general quarrying ever published. Previous books have been devoted to slate, marble, or some other special branch of the subject. Moreover they are now out of date as regards modern mechanical contrivances for drilling and lifting. The mining engineer is apt to look lightly on quarrying operations, forgetting that a different class of problem faces the excavator of stone from that familiar to the excavator of ore. The former has to remove his material without shattering, while the skill of the latter consists in following the metallic content rather than the rock. Another common misconception is that stone is obtained solely from open-cut workings. An instance to the contrary is provided by the Oakley Slate company, whose property in North Wales contains over 40 miles of underground workings. The stone industry is of sufficient importance to support excellent technical periodicals in England and America, and the *Mine and Quarry*, published by the Sullivan Machinery Company, devotes a large part of its space to this subject. As regards the qualifications of the authors of this book, Mr. Greenwell was at one time a surveyor of highways and has written books on roads, and Mr. Elsdon is lecturer on engineering geology in the University of Liverpool and author of a book of unusual merit, entitled 'Applied Geology.' Though the book deals chiefly with British quarries and practice, much information is also included relating to American and Continental methods.

The first chapter discusses the various useful stones and their distribution through the geological series, and the second deals with rock structure, joints, bedding and cleavage planes, etc. Next comes a discussion of the prospecting and investigation work requisite to determine the practicability of quarrying any particular deposit, and then a description of the opening, development, and working of a quarry. Special attention is given to underground workings. The sixth chapter describes the tools used for splitting, drilling, and channelling, and the seventh deals with blasting. The next three chapters deal with the various methods of lifting the stone from the quarries, ropeways, haulage, wire-ropes, etc., and the eleventh with the preparation of stone for the market, making macadam, splitting slates, and cutting building stones. There are additional chapters on accidents and their prevention, and on the laws and regulations relating to quarries.

Geology and Ore Deposits of Kalgoorlie, Part I. By E. S. Simpson and C. G. Gibson. Paper covers, 198 pages, with maps and illustrations. Perth: The West Australian Geological Survey.

Three years ago C. G. Gibson wrote an outline of the results of the work done by the Survey on the Kalgoorlie geology and ore deposits, for publication in the monthly journal of the West Australian

Chamber of Mines, and we gave a full abstract of his papers. Since then, an extensive monograph on the subject by C. O. G. Larcombe has been published as a volume of the Transactions of the Australian Institute of Mining Engineers, which has in a way taken the wind out of the sails of the official memoir now published. This volume is only the first instalment, and will be supplemented by a bulletin containing an account of the structural relations of the ore deposits and the general tectonics of the district when the underground survey now in hand is completed.

Determinative Mineralogy. By J. Volney Lewis. Cloth, octavo, 150 pages, illustrated. New York: John Wiley & Sons; London: Chapman & Hall. Price 6s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This book has been prepared by the professor of geology and mineralogy in Rutgers College, New Jersey. The table for the determination of minerals by means of their chemical and physical characteristics is unusually complete, and is intended for the use of engineers in the field as well as the student in the mineralogical laboratory.

Oil Handbook. Edited by A. N. Jackman. Pocket size, flexible cloth, 420 pages. London: *The Financial Times*. Price 2s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This book gives particulars of companies controlling mineral-oil properties. The present issue is the 4th edition.

Petroleum in Southern California. By P. W. Prutzman. Cloth, octavo, 440 pages, with maps and illustrations. Sacramento: California State Mining Bureau.

This publication constitutes Bulletin No. 63 of the California State Mining Bureau, and describes the oil districts in the coastal regions of the south of California, particularly in Santa Barbara and Los Angeles counties.

The Oil-Shales of the Lothians. By R. G. Carruthers, W. Caldwell, and D. R. Stuart. Octavo, paper covers, 200 pages, with maps and illustrations. London: Edward Stanford. Price 2s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The Scottish deposits of oil-shales, west of Edinburgh, formed the subject of an extensive memoir published by the Geological Survey of Scotland in 1906. This was based on work done in the field during the years 1884 to 1887. In earlier days, that is to say in 1857, Archibald Geikie made a geological survey of the Edinburgh district. At that time none of the calciferous sandstone series was being worked for oil-shale, though Young had already founded the oil industry of Scotland by discovering that the Torbanehill Mineral seam, near the base of the Coal Measures, was amenable to distillation. Young had previously, in 1847, recovered petroleum from the Alfreton coal-pit in Derbyshire. It was not until the expiry of Young's patent in 1864 that the Scottish oil industry commenced to assume important proportions.

The memoir published in 1906 was rapidly exhausted, and in the preparation of another edition, the geologist, R. G. Carruthers, ascertained new facts and made new deductions. The edition now issued therefore supplants the former. In addition to the geology, the memoir contains a section by W. Caldwell describing the method of mining, and another by D. R. Stuart on the distillation and the chemical problems involved.

COMPANY REPORTS

Otavi Mines & Railway.—This company was formed in Berlin in 1900 to acquire a copper-lead property in German Southwest Africa. A railway 350 miles was built by the company to connect the property with the port of Swakopmund, and afterward



Southwest Africa.

sold to the German government. Most of the ore is shipped to Europe, and other ore is smelted on the spot, yielding copper matte and metallic lead. The ordinary share capital is 4,000,000 marks, divided into 200,000 shares of 20 marks each, and there are 200,000 deferred shares of no specified face-value. Dividends were first paid in 1908. The report now issued covers

the year ended March 31 last, and shows that the smelting operations on the spot have been still further curtailed, and more ore shipped to Europe. This change has been made additionally favourable by the higher prices ruling for the metals. The total ore mined was 54,100 tons, as compared with 38,200 tons the year before. Of this, nearly all came from the Tsumeb mine. The shipments amounted to 44,550 tons, as compared with 29,600 tons, averaging 13% copper, 25% lead, and $7\frac{1}{2}$ oz. silver per ton. The average copper content was 3% lower than last year, due to a parcel of 8000 tons of old low-grade dump-ore being shipped. This parcel accounts partly for the increased shipments, but the increase is due also to greater activity at the mine. The smelter produced 655 tons of copper matte, and 400 tons of argentiferous lead, as compared with 991 tons and 913 tons respectively the year before. At the Tsumeb mine, the main shaft has been sunk to 130 metres, at which point a 5th level has been commenced. The ore developed so far is equal in quality to that found above, and in addition to carbonates and oxides, galena and chalcocite are present. Concentration plant is to be erected for the treatment of some of the ore. The profit and loss account shows receipts of 8,684,452 marks from the mining operations, and 4,921,287 marks on the railway. After payment of all expenses and allowing 1,289,237 marks for depreciation, the profit was 3,820,310 marks. Out of this, 450,000 marks was placed to reserve, 227,027 marks paid as bonus to the board of directors, 1,600,000 marks paid as dividend on the ordinary shares, being at the rate of 40%, and 1,400,000 marks paid to the holders of deferred shares.

Cornwall Tailings.—This company was formed in 1910 to buy the tailing heaps belonging to the Carn Brea & Tincroft tin mines. The control is with the Lempriere-Robinson group, Arthur Richards is managing director, and Ross K. Macartney is manager. The tailing is transported to the Wheal Agar dressing-floors, where it is re-ground and treated in the usual type of concentration plant. During the year ended February 28, the amount handled was 78,885 tons wet, equal to 67,050 tons dry, assaying 19.1 lb. metallic tin per ton. The yield was 351 tons of black tin, equivalent to 10 lb. black tin or $7\frac{1}{2}$ lb. metal per ton of tailing treated. The income was £38,144, or approximately 10s. per ton, and the net profit after allowance for purchase of tailing and depreciation, £15,835, or 4s. per ton. The sum of £12,500 has been distributed as dividend, being at the rate of 25%. Since the termination of the year under review, the monthly tonnage has been increased from 7500 to 9000, and the cost has been decreased by a shilling per ton. Mr. Richards mentions that he is still investigating chemical processes for the treatment of the tailing, but is not yet ready to recommend one. The reserve of tailing amounts to about one million tons.

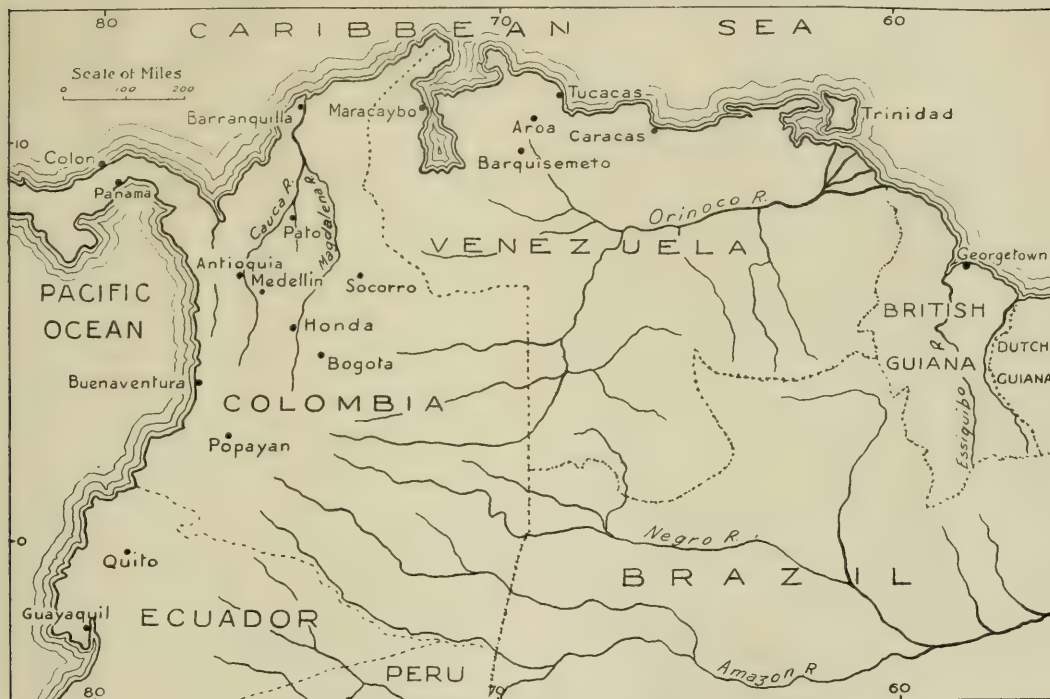
Anantapur Gold Field.—This company was formed in 1906 by John Taylor & Sons to acquire territory that contains old workings, in the district of Anantapur, Madras Presidency. Two mines have been developed and sold to subsidiary companies, the North Anantapur and the Jibutli. The report for the year ended March 31 shows that prospecting work has been actively prosecuted on the southern part of the Ramagiri Block, under the direction of the superintendent, W. Stonor. He states that a lode has been proved to a depth of 200 ft., where driving has been done for 141 ft. Of this distance, 65 ft. assayed 1 oz. over 1 ft. 6 in. At this level the country rock and orebody are much disturbed, so it is proposed to sink deeper to reach more settled ground. Further working capital will be

required shortly, and it will probably be raised by floating the property as a separate company. The shareholders have already received dividends in the form of vendor shares in the North Anantapur and Jibutil companies, and the company still holds shares in these subsidiaries.

South American Copper.—This company was formed in 1907 to acquire the Aroa, San Antonio, and Titiaira copper mines, 50 miles from the port of Tucacas, Venezuela. These mines were worked from 1882 to 1894 by the Quebrada Railway Land & Copper Co. In the latter year a serious cave at the Aroa stopped operations, and as the copper market was weak at the time, the property was abandoned. The chairman of the present company is Herbert Edwards; W. J. C.

a capacity of from 100 to 200 tons per day. By means of this plant it will in the future be possible to ship matte to Europe instead of ore, and to utilize large amounts of lower-grade ore that will not stand the cost of shipment.

Prestea Block A.—This company was formed in 1903 to acquire property from the Prestea and Appantoo companies in West Africa. Milling commenced in 1906 but was suspended from 1909 to May 1911, pending further developments. In 1909, 250,000 new £1 shares were subscribed by Wernher, Beit & Co., and in 1910, 100,000 shares were sold to shareholders. In January 1911, the property of the Prestea company was absorbed, in consideration of 199,876 shares. The total issued capital is £1,049,876. As further funds



THE NORTHWEST OF SOUTH AMERICA.

Scrutton is mine manager, and W. A. Heywood is consulting metallurgist. The capital is £15,000, divided into 150,000 shares of 2s. each. Of these, 40,937 have been issued at £1 each and the full amount paid-up; while a further 34,063 have been issued at £1, but only £319 called up. The company therefore has had cash resources far greater than the small nominal capital would indicate. Up to the present time, an income has been earned by shipping ore to Europe, and the net yearly profits (not dividends) have been £8562, £6715, £13,623, £25,109, and £37,211 respectively. The report for the year ended June 30 last does not state how much ore was shipped, but gives the gross receipts at £89,055 and the net profit £37,211, out of which £3721 was paid to the directors as extra remuneration. The balance brought forward from the previous year was £10,368, so that the total available balance was £43,858. Out of this, £41,743 has been paid as dividend. The report mentions that W. A. Heywood has made an examination of the ore deposits, and has designed a smelting furnace having

were required, £150,000 has been advanced on loan by the Central Mining and the Fanti Consols. Edmund Davis is chairman of the company, H. F. Marriott is consulting engineer, and William Crosley is manager. The report for 1912 shows that 172,319 tons of ore was treated, yielding gold worth £296,381, being a recovery of 34s. 4d. per ton. The cost was £249,130 or 28s. 10d. per ton. In addition £8906 was paid as interest on the loan, and £24,090 was written off for depreciation. The whole of the 110 stamps have not been in operation, the average being 70. The gold is recovered chiefly on amalgamating tables and from the roasted concentrate. The cyaniding of the sand yields little profit, and the slime is not treated at all. W. R. Feldtmann has recently investigated the metallurgical problem, and modifications are to be introduced. The ore reserves have been re-estimated during the year, and deductions have been made in respect of ore that must be left to prevent the surface from sinking. The figure on December 31 was 835,014 tons averaging 44s. 5d. per ton, as compared with 975,101

tons averaging 41s. 6d. on December 31, 1911. During the year, 173,436 tons was developed, and the content was higher than the average of the mine, a fact that forms an encouraging feature in connection with the future working of the mine.

Abbontiakoon Mines.—This company was formed in 1909 as an amalgamation of two other companies owning gold mines at Tarkwa, West Africa. Edmund Davis is chairman, Arthur E. Pettit is consulting engineer, acting on behalf of the Consolidated Gold Fields of South Africa, and Henry Hay has, until recently, been manager. Before the amalgamation, the ore had been treated in ball-mills and cyanide plant. As this plant did not answer, a mill of 25 stamps and 2 tube-mills was provided, together with sand and slime plant. This started work in July 1912. The report now issued covers the year 1912. During the period from the starting of the mill to the end of the year, 46,415 tons of ore was treated, yielding gold worth £79,283, or 34s. 2d. per ton. The working cost including depreciation was £72,505, or 31s. 3d. per ton. The cost does not include the item of £4878 interest paid on money advanced by the Fanti Consolidated and Gold Coast Amalgamated companies. The mill has not been worked to its full capacity, 11,000 tons per month, owing to shortness of underground labour. Mr. Hay reports that the ore mined during the first months happened to be above the average grade of the known reserve. The reserve is calculated at 629,942 tons averaging 10 dwt. per ton. A large amount of ore has also been blocked-out having an assay-value of less than 6 dwt. per ton. This is not profitable under present conditions. The issued capital of the company is £625,457.

Offin River Gold Estates.—This company was formed in 1900 to acquire dredging rights on the Offin river, West Africa. F. N. Best is chairman, and P. A. Westcott manager. Gold has been produced regularly since 1904, the total value amounting to £186,003, but no dividend has been paid. The issued capital is £282,917, of which £30,000 is in preference shares, and there are £24,000 debentures. The report for 1912 shows that gold worth £22,183 was won. After allowing £2690 for depreciation, a net profit of £1142 was left. Three dredges were employed, but owing to the low level of the river following a comparatively dry season, they could not be worked to the best advantage. The fourth dredge, which was wrecked in 1911, has been floated and rebuilt, and has since been put in commission. In 1910 a tin-mining area, 20 miles southeast of Naraguta, in Northern Nigeria, was acquired. This is being tested by George Bailey, and tin is being won by calabashing. The cost during 1912, less proceeds of sale of concentrate, was £4708; this has been charged to capital account.

Treasury Gold Mines.—This company was formed in 1891 to acquire from other companies small properties on the outcrop in the central Rand. The control is with the Neumann group. A new mill of 40 stamps was built in 1896 and 20 stamps have been added since. Dividends were paid from 1892 to 1906. In 1910 an arrangement was made with the Jumpers Gold Mining company, owning another small mine adjoining, and under the control of the Central Mining group, to work the two mines conjointly in order that the remaining ore in both should be more conveniently extracted. The management of the two mines was vested in the Central Mining, and the profits were to be distributed two-thirds to the Jumpers and one-third to the Treasury. The report for the year ended March 31 shows that operations at the Jumpers were suspended in January, and that the reserve at the

Treasury would not last for more than a month or two. The mine has since been closed. During the year, 78,050 tons was treated, together with about 30,000 tons of accumulated slime. The proportion of profit accruing to the Treasury company was £4880. The balance of profit brought forward from the previous year was £86,618, and £67,500 has been distributed as dividend, being at the rate of 12½%.

Wanderer (Selukwe) Gold Mines.—This company was formed in 1899 to acquire the Wanderer, Ashton, and other gold mines, in the banded ironstones of the Selukwe district of Rhodesia. Of recent years the yield per ton has been very small. In the summer of 1909, the company was reconstructed, and additional capital raised for the purpose of purchasing the Camperdown property in the same district. The ore is crushed dry in rolls and cyanided, and the total cost is unusually low, the working cost last year being 6s. 5d. per ton. The report for the year ended April 30 last shows that the Camperdown mine has been exhausted, and that although 10,171 ft. of development work was done at four mines during the year, only 38,150 tons of ore was disclosed at the Wanderer, and 6436 tons at the Kemerton, the results at the Ashton and Camperdown being *nil*. The ore reserve on April 30 stood as follows: At the Wanderer, 33,110 tons, Kemerton 4000 tons, Ashton 20,321 tons, and Camperdown 10,500 tons, total 67,931. The ore treated during the year totalled 222,445 tons, of which 52,107 tons came from the Wanderer, 45,320 tons from the Kemerton, 12,733 tons from the Ashton, and 112,285 tons from the Camperdown. The yield of gold was 19,927 oz., valued at £83,997, being a recovery of 1.81 dwt. per ton. The net profit was £11,376, which was carried forward. The ore from the Camperdown was exhausted at the end of May, and that from the Kemerton and Ashton mines was not expected to last after July. A new shoot of ore has been found in the Wanderer, sufficient to supply 6000 to 7000 tons of ore per month, instead of 19,000 tons, the average figure until recently. With this reduced output the ore will have to be selected, as anything less than 3½ dwt. will not pay at the reduced rate of working. Up to the present time the company has treated 1,893,658 tons of ore and recovered 212,196 oz. gold, worth £900,723. But no dividend has ever been paid. Edmund Davis is chairman of the board of directors.

Eldorado Banket.—This company was formed in 1906 by the Rhodesian Exploration & Development Company to acquire the Eldorado gold mine, in the Lomagunda district of Rhodesia. Dividends have been paid since 1909. The report for the year ended March 31 shows that 87,186 tons of ore was raised and treated, and the yield of gold was 52,903 oz., worth £225,266, being 12.1 dwt. or 51s. 8d. per ton. The working cost including development was £102,704, or 23s. 6d. per ton, leaving a working profit of £122,562, or 28s. 1d. per ton. The item of depreciation, £21,148, was not charged to current expenses, but was written-off out of the reserve fund. The shareholders received dividends amounting to £90,000, being at the rate of 30%, and £3000 was paid to the directors as percentage of profits. The development has been retarded during the year owing to the necessity of repairing the main vertical shaft, and substituting steel sets for timber. The 10th level has in the meantime been opened from winzes sunk from the 9th level, and the 11th level is to be opened in the same way. In the levels between the 2nd and 7th, serious caves have occurred in the stopes of the Main Reef, and it is feared that much rich ore will be entirely lost, or at any rate so much mixed with barren schist as to be

come low-grade. The Parallel Reef has proved to be unprofitable below the 7th level. The table giving particulars of the orebodies is not inspiring, for the length has steadily declined from 1073 ft. on the 5th level, to 280 ft. on the 9th and 105 ft. on the 10th. The ore reserve is calculated at 62,849 tons in the Main Reef and 11,977 tons in the Parallel Reef, making a total of 74,826 tons, averaging 16·4 dwt. Under present circumstances it has been found necessary to send ore of lower average grade to the mill than hitherto, and during the current year the profit will be greatly reduced. Since the absorption of the assets of the Rhodesian Exploration & Development Co. by the Gold Fields Rhodesian Development Co., in January 1912, the control has been with the latter company. W. F. H. Dudgeon is the consulting engineer.

Golden Kopje Proprietary.—This company was formed in 1912 by the Gold Fields Rhodesian Development Co., to acquire a number of mining claims of which the Golden Kopje and Union Jack are the most important, situated about 17 miles west of the Eldorado mine in the Lomagundi district of Rhodesia. The report now issued covers the year ended March 31, and shows that development has been actively continued at both the properties named. At the Golden Kopje the ore reserve is estimated at 210,204 tons, averaging 6 dwt., together with partly developed ore estimated at 14,000 tons and assaying 6½ dwt.; no further development is to be done at present, and the mine is being prepared for stoping. At the Union Jack the ore reserve is estimated at 45,034 tons, averaging 13 dwt. per ton, and the probable ore at 41,508 tons, averaging 13·6 dwt. per ton. The metallurgical plant to be used is being brought from the Ayrshire mine. Its capacity is 10,000 tons per month. The balance sheet shows that the issued share capital is £448,568, of which £224,868 represented vendor shares, and £223,700 cash, of which £200,000 was provided by the vendors. On the other side of the accounts appears the item of £50,000 paid in cash to the vendors as commission on the subscription of the £200,000. The vendors also received £23,700 in cash as part purchase price. Recently the company has borrowed £50,000 from the Gold Fields Rhodesian Development Co. as further working capital.

Antelope.—This company was formed in 1908 to acquire a gold-mining property in the West Gwanda district of Rhodesia, situated 60 miles due south of Bulawayo. It was promoted by the Rhodesian Exploration & Development company, but the control passed last year into the hands of the Consolidated Gold Fields. The report for 1912 shows that development work has been continued, 5367 ft. having been done. The lowest level is the 10th, where the lode has been cut, and proved for 50 ft. to contain 10½ dwt. over 3½ ft. The ore reserve on December 31 was estimated at 124,601 tons, averaging 10·1 dwt. in the Main Reef, 6217 tons, averaging 8·3 dwt. in the Eastern Section, and 14,579 tons, averaging 5·9 dwt. in the Parallel Reefs. A year ago the reserve at the Main Reef was 102,602 tons, averaging 10·2 dwt. It will be seen that the increase was small. The reason was that much time was spent in altering the shaft from vertical to incline at the 8th level and excavating an ore-bin there. The metallurgical plant is in course of erection and should be ready in September. This plant contains ball-mills, roasting furnaces, grinding and amalgamating pans, and cyanide plant. The issued capital of the company is £348,282, of which £278,032 represents cash subscribed. H. A. Piper and A. J. Fraser are the engineers, acting for the Gold Fields group.

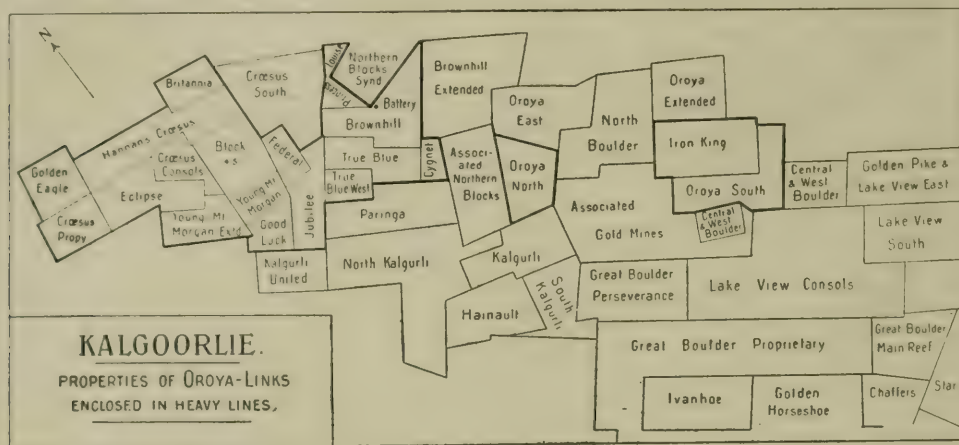
Thistle-Etna Gold Mines.—This company was formed in 1908 to acquire the Thistle, Etna, Faith, and other mines in the Hartley district of Rhodesia. The control is with the Consolidated Gold Fields. A reduction plant containing Chilean mills and cyanide plant was erected at the Etna mine with a capacity of 3000 tons per month. No profit has been made, and at the end of 1911 milling was suspended with a view to further development being done. The mill was restarted on October 1, 1912. The report for the year 1912 now issued, shows that during October, November, and December the mill treated 7300 tons for a yield of 2892 oz., or 7·9 dwt. per ton. The revenue was £12,528, and the cost £15,261. In addition £14,792 was spent out of capital on development during the time the mill was idle. A. J. Fraser, the consulting engineer, reports that the future of the Thistle and Etna is discouraging and that the available ore will be soon exhausted. The Faith, on the other hand, promise to become a rich mine on a small scale.

Kyshtim Corporation.—This company was formed in October 1908 to acquire the whole of the share capital of the Kyshtim Mining Works Co., a Russian company operating copper and iron mines in the Perm district of the southern Urals. Details of the copper mines and of the new smelting works have been given from time to time in the columns of this Magazine. R. Gilman Brown, the consulting engineer, reports that during the year 1912 the production of ore from the various mines was as follows: Koniukhoff 137,825 long tons, averaging 2·99% copper, 2·4 dwt. gold, and 1·2 oz. silver; Smirnoff 151,886 tons, averaging 2·98% copper, 2·2 dwt. gold, and 1 oz. silver; Tissoff 58,139 tons, averaging 3·12% copper, 1 dwt. gold, and 0·9 oz. silver; total 347,850 tons, averaging 3% copper, 2 dwt. gold, and 1·1 oz. silver. The total shipped to the smelter at Karabash was 298,014 tons, and to the old Kyshtim works 40,365 tons, mostly fine ore. The fine ore is made into a matte and sent to Karabash for further treatment. The production of blister copper was 7030 tons at Karabash and 384 at the old Kyshtim converters now closed, a total of 7314 tons. At the electrolytic refinery, 7547 tons of refined copper was produced, together with gold-silver slime that sold for £129,020. The ore reserve on May 1 was estimated at 2,565,000 tons. The feature of the year's work was the discovery of the Amerikansky lode, two miles south of the Smirnoff mine. By means of eleven bore-holes, an orebody 750 ft. long at a depth of 500 ft. has been defined, having an average horizontal width of 13·3 ft., and representing about 117,000 tons for each 100 ft. vertical. The average of the bore-hole assays was 3·45% copper, 3·4 dwt. gold, and 1·5 oz. silver. The Karabash plant is being extended; a third blast-furnace has been built; when all is complete the output of copper will be 10,000 tons per year. The profit from the copper operations during the year was £538,563, and the net profit in Russia was £468,401. Out of this, £100,000 was written off for depreciation, £23,420 was placed to reserve, £48,560 allocated to Russian taxes, and £296,421 distributed as dividend by the Russian company. The English company also received £35,139 as interest and commission, and paid £37,960 as interest on debentures, £13,273 as directors' remuneration, and £3494 as office expenses, leaving a profit of £276,788. The English shareholders received £265,464, being at the rate of 4s. 6d. per £1 share. During the year under review, the remaining £250,000 debentures were issued, bringing the total to £650,000. Since the close of the company's financial year £572,400 of these debentures have been converted into ordinary shares, with the par value of

£228,960. There remain £77,600 debentures not yet converted.

Orsk Goldfields.—This company was formed in 1906 by the Siberian Proprietary to acquire gold mines in the province of Orenburg, in south Russia. These mines however proved valueless, and subsequently a gold-gravel property was acquired near Nicolaievsk, on the Okhotsk sea in eastern Siberia. A stacker-scow was first erected on the Pokrowsky claim, and afterward a dredge was obtained from New York and placed on the Kolchan creek. The report now issued covers the year 1912, Russian style. The Kolchan dredge was in operation from May 18 to November 7, and treated 382,550 cubic yards of gravel for a yield of gold worth £25,246, or 1s. 3 $\frac{3}{4}$ d. per cu. yd. The Pokrowsky stacker-scow worked from May 23 to October 8, during which time it treated 68,645 cu. yd. of gravel for a yield of gold worth £11,416. The total

not until July 1912 that operations were resumed. At the same time a slime plant that had been erected was put into commission. The report for 1912 shows that from the resumption of work until the end of the year 23,793 tons of ore was sent to the mills, yielding by amalgamation gold worth £19,712; 11,755 tons of sand and 9205 tons of slime yielded gold worth £5324; and gold worth £972 was recovered from 150 tons of concentrate. The output from all sources was £26,009. The expenditure in Russia was £26,608, £6047 was allowed for depreciation, £2344 represented London expenses, and £5009 was written off development redemption. The net loss for the year was £14,028. The ore reserve is calculated at 26,270 tons averaging 7 dwt. per ton. The developments on the 680-ft. level have been disappointing owing to faulted ground. The 780-ft. level does not appear to be affected by faulting, so better results are expected.



yield from both sources was worth £36,662. The 'working cost' was £10,509, winter up-keep £3044, administration charges £10,583, royalty £5921, London expenses £2689, and allowance for depreciation £6772. The loss for the year was £3144. The Kolchan dredge did not treat as much ground as estimated, for several reasons: the winter commenced fully 30 days earlier than usual; time was lost at the power plant; and while digging on the irregular ground on the east bank it was impossible to fill the buckets to their full capacity. Operations at the Pokrowsky stacker-scow were suspended early in order that its conversion into a 3 $\frac{1}{2}$ -ft. dredge should be completed in time for the opening of the 1913 season. Prospecting for further gravel deposits has been conducted during the year without success. A quartz outcrop carrying free gold was discovered, but the vein proved to be a small one. W. H. Lanagan is manager.

Troitzk Goldfields.—This company was formed in 1906 to acquire from the Siberian Proprietary company, of which Heyman Orkin was promoter, the Troitzk gold mine in the Kotchkar district of Orenburg, South Russia. Hooper, Speak & Co. are the consulting engineers, and J. R. Horsley has recently succeeded H. C. Bayldon as manager. A new plant consisting of 6 Chilean mills and sand-treatment vats was built in 1909. A description of this plant by Mr. Bayldon appeared in our issue of January 1911. In May 1911, a fire destroyed the upper part of the main shaft and much of the hoisting and pumping plant. It was

Oroya Links.—This company was formed under West Australian laws in 1907 to acquire the property at the north end of Kalgoorlie, belonging to the Golden Links, a company originally formed in 1896. In 1909, additional property was acquired from the Oroya-Brownhill and the Kalgoorlie Amalgamated, and at the same time the name was changed. Bewick, Moreing & Co. are the general managers, and P. Fitzgerald is superintendent. The report for the year 1912 shows that 131,880 tons of ore was mined, of which 60,555 tons came from the Eclipse, 44,223 from the Oroya North, 22,887 tons from the Brownhill, 2119 tons from the Oroya South, and 2096 tons from the Block 45. By roasting and cyaniding 36,358 oz. of gold, worth £154,398, was obtained, being a recovery of 23s. 4d. per ton. The amount left in the residue was 1s. 10d. per ton. Additional income of £8002 was obtained from tributors. The cost of mining and treatment was £109,703, or 16s. 5d. per ton, a decrease of 3s. 4d. per ton as compared with 1911. London expenses and taxes absorbed £5140; £2385 was allowed for depreciation; £13,800 written off development account; and £28,750 distributed as dividend, being at the rate of 10%. The chief development work was done at the Eclipse and Oroya North. At the former an important discovery was made on the 7th level, where the lode averaged 24 ft. wide and 40s. per ton in content. The estimate of ore reserve is confined to the Eclipse, where the general managers estimate the proved ore at 114,537 tons, averaging 25s. 6d. per ton, together with 60,000 tons of probable ore.

Associated Gold Mines of Western Australia.—This company was formed in 1894 to acquire the Australia and other leases at Kalgoorlie. Dividends were paid from 1898 to 1909; subsequently the profits were devoted to further prospecting and development. The report for the year ended March 31 shows that it is possible to resume the payment of dividends. During the year, 125,169 tons was treated by dry-crushing, roasting, and cyaniding, and 37,892 oz. gold extracted, worth £161,042. The recovery per ton was 25s. 8d., the working cost 19s. 2d., and development 3s. 1d. • The total working cost was £120,015, and the cost of development £19,378. In addition £4653 was written off for depreciation of plant. The available balance was £17,258, out of which £12,384 has been distributed as dividend, being at the rate of 2½%. D. F. McAulay, the manager, is not able to give exact estimates of ore reserve. He states that a year ago he considered 500,000 tons, averaging between 21s. and 29s., as the probable ore reserve. During the year, out of 3336 ft. of development in ore, 879 ft. was in ore over 20s. per ton and averaging 43s. The ore broken in the stopes amounts to 43,199 tons, averaging 23s. 5d. per ton. The indications are that the average content of the ore mined during the current year will be less than during the past year. An interest has been acquired in the Keeley mine in Ontario.

Consolidated Gold Fields of New Zealand.—This company was formed in 1896 to acquire, from David Ziman, properties in the Reefton district, on the west side of the south island of New Zealand. In the same year the Progress mine was floated as a subsidiary company, as was also the Blackwater in 1906. The company itself works the Wealth of Nations mine. During the year 1912 operations were seriously curtailed by the general strike of miners in New Zealand, and from May to November the mine was idle. The amount of ore treated was 10,936 tons, which yielded bullion worth £17,432. The working cost is returned at £11,709, but in addition £2868 was spent on administration, £2069 spent during the strike, £7061 allowed for depreciation, and £918 paid as taxes. Interest and dividends brought an income of £1936. The net loss for the year was £4782, and the credit balance after bringing forward £51,599 from the previous year was £46,816, which was carried forward. The company holds 169,943 shares in the Progress company and 93,224 shares in the Blackwater. The issued capital is £242,377 in ordinary shares, and there is a founder's share which is entitled to 25% of the profits after 100% has been paid on the ordinary shares. The founder's share received the first dividend in 1911. This share has now been commuted by arrangement with the Progress company. The latter company owes nearly £50,000 to the Consolidated, and as a means of defraying this indebtedness

surrenders all the rights attaching to the founder's share. In its turn the Progress company issues £50,000 5% debentures exchangeable into Blackwater shares at 22s. 6d.; these debentures form the bulk of the consideration paid by the Progress company for the acquisition of all interests in the founder's share. It will thus be seen that by remitting the indebtedness of the Progress company, the Consolidated company frees itself from the payment of the 25% founder's



share in the future profits. As regards ore reserve, A. Winter Evans, the manager, states that in spite of the limited development the position continues favourable.

Progress Mines of New Zealand.—As recorded in the above paragraph, this company was formed in 1896 to acquire property at Reefton, New Zealand. During the year 1912, the operations were stopped for 6 months by the general strike of miners, and only 8770 tons of ore was treated. The bullion produced was worth £12,542, and £8332 was received from the sale of concentrate. The total income was £20,991, and the current expense was £20,219. In addition, £2911 was written off development account, £4018 al-

lowed for depreciation, £1306 paid as interest on the loan from the Consolidated company, and £209 paid as taxes. The net loss for the year was £8674, and adding this to the debit balance £17,242 brought forward from the previous year, the adverse balance on December 31 last was £25,916. Owing to interruptions caused by labour troubles, it has not been possible to push forward the development scheme outlined a year ago.

Blackwater Mines.—This company was formed in 1906 by the Consolidated and Progress companies, mentioned in the two preceding paragraphs, to acquire a gold-mining property at Reefton, New Zealand. During 1912 the strike stopped work for 7 months. The mill treated 11,538 tons of ore, yielding bullion worth £26,596, and concentrate selling for £2170. The working cost was £22,220. In addition, £1949 was allowed for depreciation, £5320 for development and shaft-sinking, and £5909 paid as taxes. The year commenced with a credit balance of £8655, and ended with a balance of £894. The developments have continued to be generally satisfactory. No new estimate of the ore reserve has been made. The figures a year ago were 71,905 tons of proved ore and 27,715 of partly developed ore, making a total of 99,620 tons, averaging 10 dwt. over 26 in. During the first six months of 1913, working conditions have greatly improved and real profits are again being made. During the years 1909, 1910, and 1911, dividends totalling 35% on the capital of £250,000 were paid, and the directors consider this mine the most promising of the group.

Broken Hill Block 14.—The mine belonging to this company is situated between those of the Broken Hill Proprietary and the British Broken Hill. For a number of years, owing to the low grade of the remaining sulphides, the operations were confined to removing as much as possible of the argentiferous lead carbonate left in the upper levels, but a year ago a contract was made with the Junction North company for the sale of sulphide ore. The report now issued, covering the six months ended March 31, shows that mining operations were greatly hindered by the short supply of labour. Only 6992 tons of carbonate ore, averaging 25.4% lead and 14.9 oz. silver, was extracted and sold, as compared with 12,484 tons during the previous half-year. Of sulphide ore, 9503 tons, averaging 15.4% lead, 12% zinc, and 12 oz. silver was mined and delivered. As more stopes are opened, an increasing amount will be mined. No new discovery has been made during the half-year. The reserve of sulphide was estimated five years ago at 220,000 tons. The accounts for the half-year show an income of £30,609 from the sale of ore, and a net profit of £7305. Out of this, £1500 has been paid as preference dividend. The ordinary shares received £15,000, being 1s. 6d. per share, partly provided out of the large balance in hand, £81,764. F. Voss Smith is manager.

Central Zinc.—This company was formed in 1906 as a subsidiary of the Sulphide Corporation, for the purpose of erecting zinc-distilling works in England intended to treat zinc concentrate produced at the corporation's mine at Broken Hill. After a period of experiment at Skewen near Swansea, the works were built at Seaton Carew, county Durham, and zinc production was commenced in 1909. The capital of the company is £150,000, all of which was subscribed in cash by shareholders in the Sulphide Corporation, and the corporation guarantees 5% interest on these shares in consideration of receiving one-third of the profits; this contract expires in 1916. The plant has been gradually increased until it now consists of 6 dis-

tilling furnaces. The construction of 2 additional furnaces is in hand. The report for the year ended March 31 last shows that 8972 tons of material was treated, yielding 3066 tons of zinc, 23 tons of blue powder, and 41 tons of metallic lead. The proportion of blue powder has been gradually decreased. The residue left in the retorts, amounting to 6270 tons, contained much lead and silver, and it was concentrated on tables, producing 3229 tons of argentiferous lead material suitable for treatment by lead smelters. The profit for the year was £9146, of which £2778 was paid to the Sulphide Corporation, and the remainder applied to the reduction of the expenditure account. J. C. Moulden is manager of the works. At the beginning of the financial year under review operations were seriously impeded by the coal strike.

Siamese Tin.—This company was formed in 1906 to acquire an alluvial tin area at Ngow, in the Renong district of the Western Siamese States. C. K. Butler is chairman and H. G. Scott is manager. The report now issued covers the first year of active production, ended March 31 last. Details are not given of the amount of ground treated or of the recovery of concentrate. The accounts show an income of £58,395 from sales of concentrate, and of £7546 from property let on tribute. The net profit was £40,822, out of which £36,000 has been distributed as dividend, being at the rate of 30%. The work has been done so far with only one dredge. Two more dredges have been ordered, each of double capacity of No. 1. One of them has already been shipped, and the other is in course of construction.

San Miguel Copper Mines.—This company was formed in 1904 to acquire from Spanish proprietors the San Miguel copper and sulphur mine, situated in the south of Spain. The directors resigned three years afterward, as their management was not a success, and the control then passed to the Pena group. The report for the year 1912 shows that 64,647 tons of ore was raised, of which 40,166 tons was sent to the leaching heaps and 23,481 tons delivered for export. The precipitate produced contained 635 tons of copper. The deliveries of washed ore amounted to 84,251 tons. The development during the year has given satisfactory results and the ore reserve is well maintained. The profit for the year was £18,389, which, added to the balance £17,844 brought forward, made a total credit of £36,233. Out of this, £12,226 has been paid as dividend, being at the rate of 7½%, and £8484 has been devoted to extinguishing the mine-development account.

Arizona Copper.—This company was formed in Edinburgh in 1882 to work the Metcalf and Longfellow groups of copper mines in the Clifton district, Arizona. In 1911 it was decided to rebuild the smelting plant and greatly extend the concentrators, so as to make it possible to treat the extensive resources of low-grade ore. The interim report now issued, covering the half-year ended May 13, shows that the production was 9283 tons of copper. The profit from the mines was £184,022, and £36,376 was received as revenue from the railway. The debenture holders received £11,908 interest, and £12,265 was paid as preference dividend. The shareholders received £113,992, being at the rate of 30%. The balance was carried forward to the fund for the redemption of the £500,000 debentures that were issued for the provision of capital for the new works. During the half-year, £223,399 was spent on the new smelter and concentration plant, making a total to date of £402,382. The new smelting works is expected to be completed this autumn.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Managing Director.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	June 30 Tons	July 31 Tons	Aug. 31 Tons
In England.....	19,233	18,037	16,829
In France.....	2,859	3,132	3,177
Afloat from Chile.....	1,350	2,175	2,300
Afloat from Australia.....	4,700	5,000	4,200
In Rotterdam.....	4,700	4,000	3,600
In Hamburg.....	3,441	1,584	2,138
In Bremen.....	1,913	1,699	1,801
In other European Ports.....	1,300	1,200	900
Total European visible supply.....	39,496	36,827	34,945

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Produc- tion.	Domestic	Foreign	Total	Stocks at end of month
Total, 1911.....	639,258	316,791	337,009	653,800	—
Total, 1912.....	706,052	365,920	333,212	699,132	—
January.....	64,053	29,111	26,956	56,067	55,000
February.....	58,460	26,641	32,219	58,860	54,600
March.....	60,822	34,190	34,682	68,872	46,550
April.....	60,416	34,892	38,346	73,238	33,728
May.....	63,088	36,209	30,477	66,686	30,130
June.....	54,402	30,559	30,396	60,955	23,577
July.....	61,640	26,296	35,035	61,331	23,886
August.....	58,764	32,897	32,706	65,603	17,047

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
Year 1912.....	8,753,563	370,731	9,124,299	38,757,560
January 1913.....	760,981	28,409	789,390	3,353,116
February.....	702,394	31,728	734,122	3,118,352
March.....	760,324	30,228	790,552	3,358,050
April.....	755,858	29,116	784,974	3,334,358
May.....	761,349	32,957	794,306	3,373,998
June.....	716,267	30,810	747,077	3,173,382
July.....	625,107	30,282	655,389	2,783,917
August.....	697,686	30,410	728,096	3,092,754

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
Year 1912.....	25,486,361	29 2	19 3	9 11	12,678,095
January 1913.....	2,296,948	27 8	18 0	9 9	1,113,579
February.....	2,100,137	27 11	18 3	9 9	1,019,774
March.....	2,321,254	27 5	17 8	9 8	1,121,786
April.....	2,301,099	27 6	17 11	9 7	1,101,099
May.....	2,366,726	26 11	17 7	9 4	1,099,397
June.....	2,177,354	27 6	17 8	9 9	1,061,507
July.....	1,873,980	27 6	19 4	8 3	785,263

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
July 31, 1912.....	182,425	8,497	15,834	207,256
August 31.....	179,111	8,766	15,934	203,811
September 30.....	180,739	8,783	15,752	205,274
October 31.....	182,058	8,803	15,496	206,357
November 30.....	186,881	8,767	14,872	210,520
December 31.....	191,316	8,634	14,965	214,915
January 31, 1913.....	200,090	9,789	13,912	222,791
February 28.....	207,662	8,877	13,918	230,457
March 31.....	207,733	9,009	15,041	231,783
April 30.....	205,424	9,053	15,626	230,103
May 31.....	197,644	9,062	15,345	222,051
June 30.....	188,094	9,060	14,654	211,808
July 31.....	170,242	9,403	13,378	193,023
August 31.....	158,223	9,236	13,172	180,631

GOLD OUTPUT OF INDIA.

Year 1911	Year 1912	Aug. 1913	Year 1913
£2,150,050	£2,265,004	£1,913,098	£1,518,822

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1909	1910	1912	1913
	£	£	£	£
January.....	204,666	227,511	214,918	220,776
February.....	192,497	203,888	209,744	208,744
March.....	202,157	228,385	215,102	257,797
April.....	222,700	228,213	221,476	241,098
May.....	225,032	224,888	234,407	242,452
June.....	217,600	214,709	226,867	241,302
July.....	225,234	195,233	240,514	249,302
August.....	228,296	191,423	239,077	—
September.....	213,249	178,950	230,573	—
October.....	222,653	234,928	230,072	—
November.....	236,307	240,573	225,957	—
December.....	233,397	199,500	218,661	—
Totals.....	2,623,788	2,568,201	2,707,368	1,661,472

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
	£		£		£	
January.....	15,903	66,107	26,098	107,262	34,857	144,262
February.....	15,179	63,081	25,009	102,270	32,544	137,038
March.....	16,387	67,673	27,228	111,378	36,289	150,060
April.....	17,237	70,880	27,790	114,796	35,295	146,220
May.....	24,427	96,409	28,015	115,678	34,507	142,617
June.....	22,555	92,174	27,784	114,697	30,503	125,764
July.....	22,510	91,955	30,974	127,800	32,345	132,936
August.....	25,385	103,753	33,015	136,407	—	—
September.....	26,717	109,039	34,491	142,397	—	—
October.....	26,826	109,503	34,436	142,414	—	—
November.....	24,289	99,299	33,183	137,700	—	—
December.....	24,369	99,569	34,917	144,382	—	—
Totals.....	261,784	1,069,442	362,940	1,497,179	236,340	978,897

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910.....	363,496	1,209,856	1,573,352	6,682,042
Total, 1911.....	160,021	1,210,447	1,370,468	5,823,522
Total, 1912.....	83,589	1,199,080	1,282,669	5,449,057
January 1913.....	9,738	94,967	104,705	444,756
February.....	8,780	92,207	100,987	428,963
March.....	754	97,015	97,769	415,294
April.....	7,920	103,324	111,244	472,532
May.....	7,094	103,085	110,179	468,007
June.....	5,112	108,373	113,485	482,050
July.....	11,705	97,091	108,796	462,133
August.....	7,611	102,558	110,169	468,070

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	Aug. 1913	1913 to date
		£	£	
Victoria.....	2,138,000	2,039,400	175,100	1,226,600
Queensland.....	1,623,390	1,484,160	107,050*	664,430*
New South Wales.....	769,353	702,129	60,018	410,227
New Zealand.....	1,808,049	1,345,115	156,348	982,959

* July figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911.....	615½	£702,599	£114 4 5
Year 1912.....	640½	£831,908	£128 5 6
January to June, 1913.....	312½	£419,207	£134 1 2
July 7, 1913.....	184	£20,386	£110 15 11
July 21.....	258½	£27,990	£108 7 8
August 5.....	21½	£23,066	£109 3 10
August 18.....	20½	£28,362	£108 11 4
September 1.....	2½	£25,493	£113 8 6

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1912 tons	Aug. 1913 tons	1913 tons
Metal from Straits to Europe and America.....	59,036	5,990	41,553
Metallic Content from Bolivia to Europe.....	21,149	1,771	16,573

REVIEW OF MINING

INTRODUCTORY.—Holiday dullness characterizes the financial markets. Dullness, and hesitation. While the Balkan war is over, its effects on international finance are still felt. The Mexican disorder has assumed an acute stage owing to American intervention. Rand affairs continue to cause anxiety. General sentiment, however, has undoubtedly improved; but no marked activity is likely pending the remainder of the holidays and the shooting season, both of which tend to lessen attendance in the City, especially among the leaders of finance. The metal markets are healthy, and favour the mining of the base metals. Copper is notably strong, and so are copper-mining shares. The Broken Hill and Nigerian departments present points of interest. A feeble effort to stimulate Rhodesian shares has been made, ineffectually. Interest in oil is on the increase, several important transactions having been closed. A rise in Consolidated Gold Fields shares is attributed to its potash holdings in California. These were described by our San Francisco correspondent in our July issue.

TRANSVAAL.—The output of gold in August shows an increase of 72,707 ounces over July, but it is 36,641 oz. less than in August of last year. These figures, however, are less significant than the labour statistics, which show a diminution of 12,019 in the supply of natives, making a total of 158,223 as against 179,111 a year ago, and 207,733 in March last. As an increase is unlikely for several months, it is plain that mining operations will be crippled for the remainder of the current year.

The nominal profits for August exhibit a decisive increase over July, but it will be noted that the improvement in many cases is due to the extraction of ore above average. A serious decrease in the output of the Central Mining-

Rand Mines group is said to be due to shortage of labour. It is rumoured that the Jupiter and Geldenhuis Deep will be amalgamated.

Dynamite outrages and explosive speeches have marked the labour quarrel on the Rand. Several arrests and the dismissal of a number of white overseers have embittered local feeling. It is reported that the mining groups have decided to recognize the Miners' Union, while refusing to acknowledge the Federation of Trades. About 3000 white workers remain unemployed. The natives are scared by the big talk of their bosses, and are being recruited slowly. No return to a full supply of native labour is likely until the end of the year. Hence the necessity for dismissing white employees, who, in some cases, complain that they are victimized. This causes a recurrence of ill feeling.

On August 15 a cablegram was published announcing the intersection of the lode in the south shaft of the Springs Mines, in the far east Rand. The ore was cut at 3690 feet and it assayed 5.81 dwt. over 53 inches. This compares with an average of 5.95 dwt. over 35 inches in the north shaft, and a previous drill-core along the line of the south shaft of 11.5 dwt. over 38½ inches. The result is disappointing, for the total (not 'working') cost will hardly be less than 18s. per ton.

The new share issue of the Modderfontein Deep indicates confidence in the Rand. An issue of 131,500 shares at 30s. per share is guaranteed by A. Goerz & Co. in return for a commission of 2s. 6d. and an option on 105,500 shares at 35s. for one year. The issue is made to provide funds for the erection of a mill to crush 30,000 tons monthly. The plant will include 75 stamps and 6 tube-mills. Development so far has indicated 750,000 tons of ore averaging 7½ dwt. over a width of 70 inches.

The working cost is estimated at 17s. 6d., to which 3s. may be added for items of expenditure usually omitted, leaving a net profit of about 9s. per ton. This is one of the far east Rand properties, and is contiguous to the two other Modderfontein mines, both of which are splendid enterprises.

The postponement of the Central Mining dividend and the cessation of work on the gold-mining portion of the Rand Collieries were announced on the same day. Both are the result of the labour disturbances. The dividends from the subsidiary companies of the Central Mining Corporation are likely to be so decreased as to render it advisable for the holding company to be conservative. As to the Rand Collieries, which is opening up a promising area in the far east Rand, it already owes £165,000 to the General Mining Corporation, and, in view of recent disappointing results on the 10th level, it would be inconvenient to finance the undertaking at the present time.

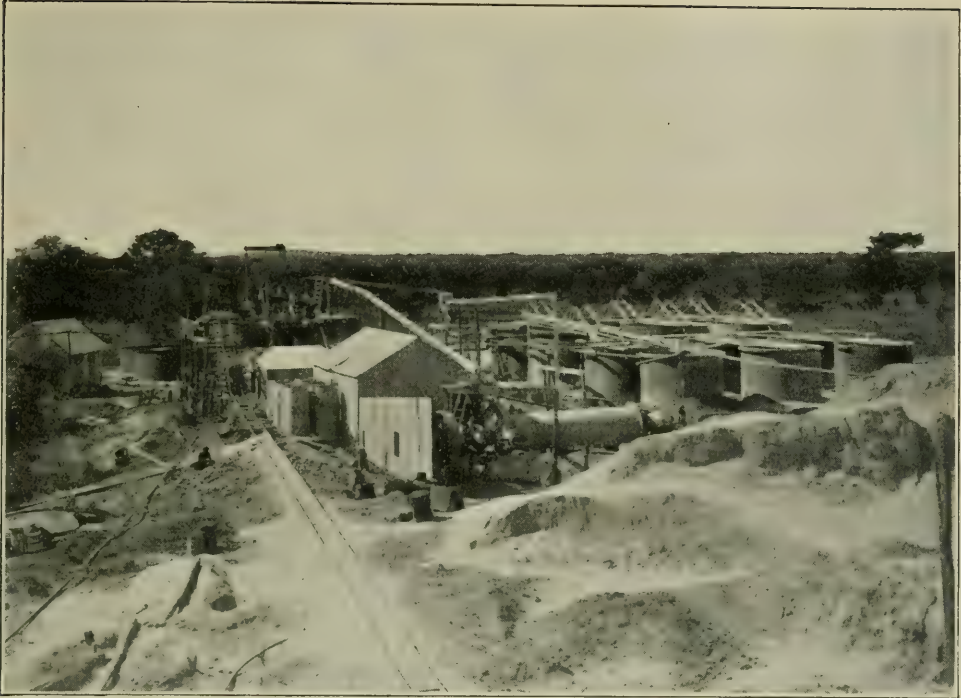
At the Brakpan the main incline south is said to be opening up excellent ore; on the 13th level west, a marked improvement is recorded; the upper eastern section also looks better. Evidence indicates the existence of a distinct ore-shoot pitching south-eastward. The Brakpan is an example of a good mine under experienced management suffering from lack of system in the publication of information. If a routine had been established in the way of giving news from the mine at short intervals, the recent unfavourable developments would not have been magnified by the natural anxiety of shareholders, nor would a big bear account have been accumulated with impunity. All the mining companies of the Rand are backward in the publication of news concerning current developments, which, however, become known on the market, to the prejudice of the proprietary. Quarterly and half-yearly records are largely out-of-date by the time they are issued in London. The shareholders are en-

titled to have more of the information that the board receives regularly from the resident manager.

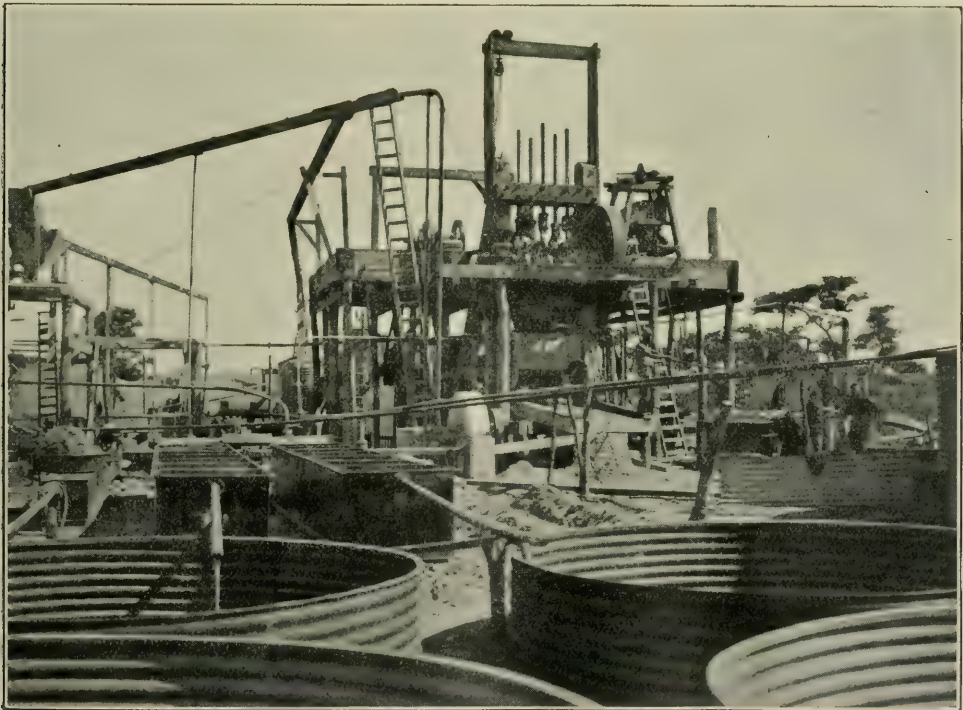
The Luipaard's Vlei directors are setting a good example in charging such items as shaft-sinking, renewals, and maintenance to revenue account. The time will come when shareholders will realize that the methods of accountants are like those of the heathen Chinese. Honest business calls for straightforward book-keeping. That apparently is the view taken by the Luipaard's Vlei board.

RHODESIA.—The July output is officially stated to have been 59,248 ounces of gold, valued at £249,302. This is a small increase over the preceding month, and over the corresponding month of last year. The number of producers advanced from 176 in June to 201 in July, indicating that there was an increase of activity among the small mines or 'prospects.' Among individual properties, the Globe & Phoenix and Lonely Reef show noteworthy gains, while the Eldorado, Giant, Willoughby, and Wanderer each exhibit a considerable decrease.

We publish a couple of photographs illustrating a tributor's plant on the Shepherd's Reef mine in the Hartley district. It is to such enterprise that the country looks for a growth in its mining. At present the industry is dull. The Rhodesia Gold Fields group and similar companies appear to be short of money, having trespassed unduly on public confidence. Hence such properties as the Planet-Arcturus are marking time. The Antelope plant is about to start. At the Golden Kopje, the old Ayrshire 60-stamp mill is being erected. New plants on the Shamva, Cam & Motor, and Falcon are nearing completion. One of the more active districts is the Shagari, about 23 miles north of Hartley. With the exception of the Turkois, the work is being done by small owners with small mills. It remains to be seen whether the ore will become refractory as the various workings are deepened, but some



TUBE-MILL AND SLIME-VATS ON SHEPHERD'S REEF MINE, HARTLEY, RHODESIA.



STAMP-MILL AND CLASSIFIER ON SHEPHERD'S REEF MINE.

of these prospects should prove valuable mines. The widening of the railway to Lomagundi has been completed to the Eldorado mine, and will be continued a few miles over the Hunyani river to the terminus, at Sinoia. Around this centre, and for 40 miles north of it, many promising farms are occupied.

The new sand-treatment plant, which cost £62,000, at the Globe & Phoenix mine, is idle pending some necessary changes. An ore-drying equipment is to be added, it being apparent that the plant cannot treat wet material advantageously. A delay of five months is probable.

There is talk of the Giant acquiring the Motor portion of the Cam & Motor mine.

WEST AFRICA.—The production of gold in July is given as 32,345 ounces, worth £132,936, or a little more than in June, but still much below the yield recorded earlier this year. Among individual mines the Ashanti maintained its output, so did the Abbontiakoon and Prestea, while the Broomassie showed a decided recovery. At the Ashanti Goldfields the cutting of the Obuasi ore-shoot on the 11th level has yielded good results, 9 feet of ore assaying 90 dwt. per ton, as against 19 ft. of 32 dwt. ore on the 10th level. The width is less than it was at the places where the ore was first penetrated on the 9th and 10th levels, but this is due, we are informed, to the fact that the cross-cuts were not vertically over each other, and that the ore on the 11th level was cut at the northwest end of the shoot. On the 11th the 9 ft. of high-grade ore lies against 5 ft. of "graphite," meaning graphitic schist.

Mr. J. J. Hunter sends a cheerful report on the Naraguta Extended, and we do not doubt that it is trustworthy, but the wording of his report is untechnical, to put it mildly. "The ground is good in values," he says, meaning probably that it is fairly rich in tin.

The dredge at the Jos is nearly ready to start. This will be an interesting event. The dredge

has a capacity estimated at 24,000 cubic yards per month, and the operating cost is given as 9d. per yard. An extraction of 80% is promised. A demonstration of this statement will be of great technical value.

The Geri River Tin company, having wisely decided to abandon its Nigerian property as worthless, has arranged to acquire the Helston Moor property, near Helston, and the Unity mines, near Gwinear, in Cornwall. Old tailing on the banks of the Cober river, near Helston, is estimated by Mr. C. H. Wray to contain 8 lb. tin per ton. The lodes, near Gwinear, are also said to be worthy of development. The digest of the report is difficult to follow. As the directors of the Geri Syndicate are on the board of the Geri River Tin Mines, it seems a pity that the latter should have to pay to the former, as intermediaries, a commission of £12,500 in shares.

INDIA.—A serious accident occurred at the Mysore mine last month. Owing to the failure of the clutch on the winding-drum at Edgar's vertical shaft, the cage was precipitated nearly 3000 ft., instantly killing all the occupants, of whom 6 were Italians, 2 Eurasians, and 34 coolies. Little damage was done to the shaft and machinery, and the output for the month was not affected. A fatal accident is also reported from the Champion Reef mine, where an 'air-blast' caused a fall of rock, killing 4 coolies and injuring several more. At this mine the bricking of the Circular vertical shaft has been completed, the depth being 3861 ft. A station is being cut at the 42nd level, 30 ft. above the bottom of the shaft. The workings at the 44th level in Carmichael's section are in ore averaging 27 inches wide with a content of 47 dwt. per ton.

RUSSIA.—The Orsk Goldfields reports a largely increased yield of gold in August, but as the cost is not given, it is impossible even to guess the real profit. However, the yardage is more than that for June and July together, being 116,000 as against 62,000 in July and

41,600 in June. This indicates the efficiency of the Pokrovsky dredge, converted from the old stacker-scow. As the yield for August is £10,342, it may be hoped that it leaves a handsome margin of profit.

The Lena Goldfields is washing gravel at the rate obtaining before the big strike, with its attendant interruption to regular operations, but the yield has declined rapidly, as forecasted in these pages more than a year ago. During

extension of mining activity in the Lena region is not likely.

Two dredges are being erected, under the direction of Mr. H. L. Symons, on the Chara river, in the Lena watershed.

AUSTRALASIA.—Mr. W. J. Loring, of Bewick, Moreing & Co., recently returned from a tour in Australia, states that the lack of enthusiasm for mining in Western Australia is surprising. The decline of the industry, due to the



Gold-Stealers' Camp in Siberia.

the present season 456,218 cubic yards has been washed for a yield of £670,146, and an average of 29s. 5d. This compares with 1911 as follows: 504,172 cubic yards, yielding £961,342, and an average of 38s. 1d. per yard. Owing to the Russian control of the local management, the British shareholders are poorly informed concerning the progress of operations.

Our own information indicates that this property has been wretchedly exploited, from a technical standpoint, and that the rich Feodosievsky ground is being gutted to average the yield from unprofitable gravel extracted in other parts of the mine. Several engineers are returning from the Bodaibo district with unfavourable reports; so that an immediate

exhaustion of the big mines at Kalgoorlie, is so depressing that the amount of new work, in the way of prospecting, is pitifully small. Complaint is made of the attitude of the Government, in enforcing regulations prejudicial to enterprise.

The recent reports of sampling from the Great Fingall have referred largely to drifts that have penetrated beyond the known limits of the orebody. The internal shaft from the No. 13 level will be completed to the 18th level in November, and the extraction of ore will be expedited thereby. Mr. Malcolm

Maclaren has expressed himself as much pleased with recent developments.

The Great Boulder's option on a mine in Alaska is not a big affair, for it involves a possible price of only \$100,000 or £20,000 on what is as yet a mere prospect.

The Gwalia Consolidated mine has been closed-down, the experiments with the volatilization process having proved unsuccessful. We hope that the results will be published, so that others may benefit from the useful work done, under manifest difficulties, by Mr. Ben Howe.

Great Cobar is in trouble again. Sheep-shearing has caused a shortage of labour, and a break-down at the crushers interfered further with production. The item of expenditure as

reported is not informing, for it includes only a portion of the expense. Realization charges and general expenses are omitted.

An English company has been registered to acquire the Mount Oxide enterprise, previously operated as an Australian corporation. Mr. Edmund Davis and the Consolidated Gold Fields are appropriately allied in the affair. It is a fine mine, we believe, and is under the resident management of Mr. Gerard W. Williams.

We note with much regret the death of William Knox, one of the organizers of the Mount Lyell enterprise, and a leader in Australasian mineral development. We remember him best as secretary of the Broken Hill Proprietary in the days of its maximum expansion. With his big hat and broad shoulders he was a notable figure in Melbourne. The size of his hat and the breadth of his shoulders expressed not only physical amplitude but the wide imagination and big heart of a man of generous instincts and continental energy.

Recent developments in the South Blocks mine indicate the good fortune of its owners, the Zinc Corporation. On the 7th and 8th levels, northward, the orebody has been proved to have a maximum width of 50 to 90 feet, assaying $14\frac{1}{2}\%$ lead, 11% zinc, and 5 oz. silver per ton.

UNITED STATES.—Our correspondent at San Francisco gives some details concerning the successful re-opening of the old Plymouth mine, in Amador county, California, by the aid of British capital, spent under the direction of Bewick, Moreing & Co.

The strike at the Lake Superior copper mines is being overcome. The English and Scottish miners have returned to work, with a majority of the Italians, but the Finns and Austrians are supporting the Western Federation, an anarchistic organization. The strike began on July 23, and has exercised a marked effect on the copper market, since this region yields 20% of the American output.

Reports from the Shushannadistrict in Alas-

ka have been exaggerated. Two thousand people have rushed to the district and a shortage of provisions is likely. The locality of the discovery is on a tributary of the Tanana, which flows past Fairbanks to the Yukon. It is likely to revive prospecting in the adjoining copper district, at the head of the White river.

MEXICO.—On another page we discuss recent events, culminating in American diplomatic intervention. The news from the mining districts continues contradictory. Some are quiet; others have been devastated. In the south the Huerta government is gaining the upper hand. Morelos has been scourged. In the north most of the mines are either shut-down or working on a reduced scale. Of the eight smelters controlled by the Guggenheims, only one, at Aguascalientes, is being operated. The southern mines, however, are doing better than last year. In Oaxaca the Natividad is said to have produced 800,000 pesos during the last few months; last year it was closed down by an Indian outbreak and all the foreigners were driven out. Among the enterprises affected by persistent brigandage is the Avino Mines. This company's warehouse was burned down in November, and in May the mine was closed down, leaving some native employees to guard the machinery, which, so far, has not been injured. The town of Avino was razed, and the company's dwellings sacked by the followers of Carranza in June. This is only a part of the hideous devastation to which the state of Durango has been subjected.

Official reluctance to give information to the Santa Gertrudis shareholders was due to the disappointing character of the development under the 18th level. The original estimate of ore in reserve, and subsequent estimates, have included a risky allowance for ore below each successive bottom level. Hence, when the ground below the 18th level failed to conform with expectations, the manager became nervous and urged the board to issue a correc-

tion, as was done finally, but not before the truth had leaked out. Since then developments have been more favourable.

OIL.—The agreement to transfer the property of the California Oilfields to the Shell Transport & Trading Company and the Royal Dutch Company is an interesting event. The California Oilfields has done well with its property at Coalinga, an oilfield described in these pages just a year ago. The consideration is £2,600,000, payable as to £400,000 in cash, and as to £2,200,000 in 400,000 ordinary Shell Transport shares, valued at £5½ each. It is also announced that the negotiations of the Shell Transport company for the acquisition of the Kern River Oilfields, another British company, have fallen through, owing to disagreement over terms. Our San Francisco correspondent refers to some of these matters.

A statement of M. Kokovtseff, the Russian Prime Minister, concerning the decline of oil production on the Apscheron peninsula, has caused worry among those interested in the Baku oil region, which is synonymous with the peninsula mentioned. In reply, Mr. Paul Dvorkovitz points to the fact that the area hitherto exploited for oil in the Baku district is within a 10-mile radius, whereas the Crown lands known to be oil-bearing outside these limits are many times more extensive. The question of opening these Crown lands to exploitation is now being discussed.

VARIOUS.—Rich gravel is reported to have been found in San Domingo. A hundred drill-holes averaged 60 cents per yard. The drilling was done under the direction of Mr. Henry F. Lefevre. But the ground is near the placer promoted by the A. O. Brown Company six years ago. It proved to have been 'salted,' whereupon the promoters returned the \$1,000,000 subscribed with 6% interest, thus setting an example rarer than much fine gold. However, if Mr. Lefevre's work is confirmed, as is likely, a new and important dredging area will be open to exploitation.

A telegram from Urga announces that rich veins of gold ore have been found in the Kudur valley, in Mongolia. We are informed that the discovery is on a concession of the Société Mongolor, of which Mr. G. Victor Van Grotte is the leading spirit.

Sensational accounts of gold discoveries at Kilo in the Congo Free State have appeared in the press. Gold is known to exist in the Lower Katanga, notably in the Kiambi district. It has been found in the river beds of the Lukulu, Kasili, and Lukushi, with indications of quartz veins in schist and quartzite.

In regard to the Socorro Gold & Silver Mines, we learn that Mr. E. Mackay Heriot's estimate of 300,000 tons of ore averaging 50 oz. silver refers to 'possible' ore, and not to ore assured. On the whole, we regard estimates of possibility as undesirable, simply because they are so easily twisted or misunderstood.

While the Pato dredge, to quote a phrase now stereotyped, "is still employed in digging towards the 310 areas of tested ground," it is obvious that some rich patches have been traversed; for example, the return for the week ending September 2 gives \$13,650 from 19,000 cubic yards. This is an average of 72 cents per yard. Indeed, we suspect that the dredge is on the edge of the tested ground. If so, the next return will possess unusual interest. Mr. Nelson Dickerman succeeds Mr. C. W. McConaughy as resident manager.

Among successful dredging enterprises we mention the Guiana Gold Co., which is operating four dredges on the Konowarook river, about 140 miles from the coast of British Guiana. It is stated that the yield is 22 c. per cubic yard, and the operating cost 10 c. per yard. Dividends of 10% have been paid since 1908. The manager is J. Henderson.

Affairs at Rio Tinto are no better. Unrest among the workmen is likely to be increased by the arrival from Madrid of Pablo Yglesias, the notorious labour agitator.

EDITORIAL

A BULL POINT for the Consolidated Gold Fields: Kent won the county championship in cricket.

THE VENDETTA being waged by Mr. Zenner against Mr. Edmund Davis may not be a heroic affair, but we are not sorry to see some searching questions put to Mr. Davis. He has not answered all those put to him at the Northern Copper meeting, and if he fails to do so, his silence will be appreciated.

NIGERIA has furnished as much humour as tin. The latest contribution of a valuable commodity comes from the Abu, where an engineer has found much ground "dark with cassiterite to a considerable depth." Was it schorl or ilmenite? No wonder he has "not the slightest doubt" that the Abu is "the Eldorado of Nigeria." Owing to its origin and etymology, it is hardly fair for the tin miner to use a myth consecrated to golden adventure.

NOT LONG AGO Mr. H. C. Hoover, in the course of an interview with the *New York Sun*, gave expression to a pessimistic opinion concerning the world-wide expansion of gold mining. Now Mr. T. H. Leggett, in the *New York Times Annalist*, makes a more cheerful forecast, instancing the resuscitation of gold mining in Nevada as exemplifying the fact that new goldfields may be uncovered in mining regions supposed to be exhausted. He also points to the interior of Asia, parts of South Africa, Brazil, and South America in general, and Canada, as regions only incompletely prospected and likely to disclose mineral resources, including the precious metals. As between these two

distinguished mining engineers, we may suggest that it is true that much of the cream has been skimmed, that the richest and most easily accessible deposits have been exploited, but that vast resources are still available in the form of low-grade material to which new methods and inventions are applicable profitably.

ELSEWHERE we comment upon the excellence and value of the papers presented to the Butte meeting of the American Institute, as indicated by the advance publication of a number of them in the July bulletin. But we note one paper that appears to have been admitted thoughtlessly: the short one on the gold placers of Antioquia. It reads like an extract from a flamboyant prospectus; it begins with a quotation from a speech by a president of the Royal Geographical Society, a gentleman as likely to be a judge of the mineral richness of Colombia as of the business opportunities at Timbuctoo; it includes flapdoodle about Antioquia as "a dredgeman's paradise," and "the whole country rock" as "more or less enriched with the precious metal." This contribution to the transactions is in the wrong place. It ought to be in a prospectus, and then in a waste-paper basket.

DOLCOATH had a pleasant meeting, rendered cheerful by the news of the discovery on the 210-fathom (below adit) level, where 9 feet of ore averaging 35 pounds of black (68% metallic) tin has been intersected by a cross-cut from the New Sump shaft. This vein belongs to the north series of lodes, and can be tested readily by cross-cutting at the 190 and 230-fathom levels. It was worked for copper in the shallower workings, but was abandoned many years ago. Borlase records

that during the first half of the eighteenth century, it was highly profitable as a copper producer, but exact records have been lost. In any event, it is encouraging to Dolcoath, and full of promise to its neighbours, East Pool and South Crofty, into whose territory these veins extend.

ANOTHER WRECK draws attention to the perils of navigation on the Alaskan coast. The steamer *State of California* went down in Gambier bay, 90 miles south of Juneau, on August 18. She struck an uncharted rock and sank in three minutes. A crowd of prospectors on the way to the Shushanna goldfield was on board and 31 persons are reported as lost. The vessels plying in the Alaskan trade are largely old steamers that have been patched, and the danger of travelling on them is heightened by the scandalous incompleteness of the charting and lighting of the coast. In this respect Alaska compares badly with British Columbia.

ESTIMATES OF TONNAGE based on cubic contents are apt to involve serious error if made carelessly. This is the story of the Bwana M'Kubwa episode. On careful test it was found that the ore averaged 70·35 pounds per cubic foot, or 28 cubic feet of oxidized ore was required to make one short ton. The discrepancy with the previously assumed unit was 56%; in other words, an error so large was made as to involve a doubling of the real tonnage. Individual tests varied within 45%, so that it is obvious that the ore is irregularly porous. We have seen no intelligent description, but assume that the ore is not only porous, but full of geodes, or vughs, as the Cornish call such cavities.

REFERENCE is made elsewhere in this issue to stock exchanges as affording a means of quick profit from mining, by means of scrip saleable to the public at a premium.

Apart from this phase of activity, it may be suggested that the stock exchange serves an even more important function in furnishing the machinery for raising working capital, which otherwise would have to be obtained from individuals or groups likely to co-operate in fixing their own terms. Against such a combine or monopoly, the stock exchange enables the operator to go to the general public on terms that can be made mutually advantageous.

THE PRESIDENT of the Institution has been worthily entertained in Canada, as one of the distinguished participants in the Geological Congress. Incidentally, we note that he has received an honorary degree, or shall we say, a degree *d'estime*, for his name appears on a toast-list as Dr. Bedford McNeill. This seems appropriate: he has the bedside manner to a fine point and his cheery humour would be the best possible antidote to hypochondria, but it seems as if he ought to have been with the 7000 at the Medical Congress in London instead of responding to 'Our Guests' at Toronto and Sudbury. However, Dr. McNeill must have proved a tonic to the jaded geologists in Ontario, and we do not doubt that his prescriptions were as timely as his diagnosis was intuitive.

SEVERAL CONCESSIONS have been made to the white miners on the Rand. The Randfontein has granted an 8-hours bank-to-bank shift, and an annual holiday of one week on full pay. A system of weekly payment is to be introduced at the West Rand mines. Of course, the comparative shallowness of the Randfontein workings renders a bank-to-bank shift less expensive than in the deeper mines of the Rand. The payment of wages weekly instead of monthly is a reasonable improvement. A man likes to be paid as he pays; the bills of a workman are payable weekly, and it is convenient therefore

that his wages should come to him at intervals similarly short. Moreover, in so far as the change tends to curtail the credit system, it will be a means of reducing the cost of living, for cash commands lower prices. Awkward incidents at the Bantjes, Volgelstruis, and East Rand mines, owing to the dismissal of white overseers rendered supernumerary by an insufficiency of native labour, have caused some anxiety. Tact and goodwill have been manifest in overcoming difficulties, but it is obvious that a state of strain persists at Johannesburg.

ELSEWHERE we refer to the decision of the Montana court in the suit upholding the Minerals Separation patent. Another judgment of hardly less importance is that given in the action against the Tonopah Mining Company of Nevada, in favour of J. A. Vincent, owner of the Alden H. Brown patent 781,711, dated February 7, 1905. This decision will apparently affect as many well established gold-mining enterprises as did that in connection with the Moore filter. The Alden H. Brown patent that has been upheld covers the use of cyanide in the battery or in the re-grinding machine, followed by classification and the removal of sulphides by concentrating plant. This is the practice widely used in the west of America and in other parts of the world, and the discovery of a valid anticipation will prove disconcerting in many quarters. Our information on the subject is not sufficiently complete to warrant any statement as to the ultimate influence of the judgment. We shall return to the subject next month.

COPPER statistics just now are all on the side of the miner. During the past month the price of the metal has risen £5½ per ton, to £74½. The shrinkage in the visible supply has been aided by events in America and Mexico, so that the total stock on hand is

smaller than it was in June 1912, when copper rose to £80. The diminution of output in the Lake Superior region, owing to labour troubles, and the interruption to production in northern Mexico, owing to political brigandage, have joined in checking the supply from the other side of the Atlantic. Stocks in America at the end of last month were 17,104 tons only, this being a less amount than at any time in 1912. Meanwhile, consumption in Europe is steadily increasing, so that deliveries during the last 12 months have been 16,287 tons ahead of the supplies, which totalled 514,232 tons. The outlook continues to be highly favourable.

LORD HALDANE is reported to have expressed admiration and astonishment at the magnitude of the equipment and endowment of the educational establishments at New York and Montreal. He referred particularly to the Columbia and McGill universities. We are not surprised that he should have been impressed; and with his surprise will be allied, we suspect, a feeling of disappointment at his countrymen's shortcomings in this regard. The imperial city of London is now squabbling over a site for its University, which, until recently, was only an examination centre and a grantor of degrees. It played no larger part in the education of this community than its neighbour, the Burlington Arcade. London is the financial centre of the world, and more particularly the great centre of mining finance, yet its School of Mines, with its pitiful prefix of Royal, has been driven from pillar to post, mainly for lack of a proper endowment. If one or several of the operators who have made vast fortunes out of the mineral resources of the British empire had had the spirit and imagination to furnish an adequate endowment for the Royal School of Mines, it would not have become merely a part of an educational agglomerate at South Kensington. The same applies to the school at Camborne. Consider-

ing what Cornishmen have done for mining all over the world, is it not disgraceful that that excellent little institution, in the heart of the Cousin Jack country, should be continually crippled for the lack of even a small endowment? We endow families not universities. We spend money on silly polar explorations and Crystal Palace schemes, not to mention the successful appeals for Titanic disasters and Indian famines, because these call to childish feelings, but we ignore habitually the fact that the British empire expanded in consequence of mineral exploration, and the industrial development of it today depends upon the training of our young manhood. Lord Haldane has shown his sympathy with technical education more than once. We hope that on his return he will be so stimulated by his American experience as to endeavour to remedy the defects so manifest in London.

PRESIDENTIAL ADDRESSES are usually delivered under conditions much more pleasant than those under which Mr. George A. Denny faced the Mexican Mining and Metallurgical Institute. When a country is in a state of protracted revolution and members are scattering to the four quarters of the globe, it is difficult to maintain the organization of an institute, and it requires a fine mental poise on the part of its president to deliver an address so full of good material as that of our distinguished friend in Mexico City. It was no easy task. The Mexican Institute has published some excellent papers in its transactions, but it is not vigorous, for causes quite apart from political disturbance. Membership is small, and support among technical men in Mexico is not as general as it should be, because it is argued by many that the professional societies outside Mexico—in New York, Toronto, and London—suffice for the record of technical progress in Mexico and for the meeting of professional men in joint discussion. Another hindrance has been the

lack of an efficient secretary, a defect due mainly to insufficient funds. We hope this may be remedied, for the Institute has served a distinctly useful function in promoting the local discussion of technical affairs and in bringing together those interested in the mineral exploitation of Mexico. Charity begins at home; professional solidarity must be local before it can become world-wide.

ON BEHALF OF the junior members of the profession, we deem it proper to protest against the entirely inadequate salaries offered by some mining companies, often for work performed under unhealthy or otherwise trying conditions. The immediate past-President of the Institution, in his inaugural address, gave a cheerful list of appointments in mining and metallurgy, but we fear that this conveyed an incorrect impression of the lucrative character of the employment open to junior members of the profession. It may also have tended to mislead parents into concluding that golden prospects are open to their sons in a profession that, as a matter of fact, is much over-crowded. But the feature most open to condemnation is the offering of petty salaries to surveyors, assayers, and junior managerial assistants at mines in the African jungle and other regions where a young man is asked to sell his birthright for a mess of pottage, that is, his health for a pittance. It is time for the Institution to look into the matter and to assist its student and associate members in concerted measures calculated to ensure reasonable salaries for competent men.

American Intervention in Mexico.

In our July issue we suggested that the time had come for the United States to intervene in Mexican affairs. This has been confirmed by the logic of events. The first step was the recall of the American ambassador, Mr. H. Lane Wilson, who, finding himself quite out of harmony with the policy of Presi-

dent Wilson, resigned. The ambassador had given his support to General Huerta, who reached his presidency by the conventional Spanish-American route, but the American government had refused to recognize the Huerta régime, and finally, in August, the President of the United States despatched a personal representative, Mr. John Lind, to ascertain the true conditions of affairs, and to submit proposals to General Huerta. These insisted on the cessation of fighting, the holding of a general election, and an undertaking from Huerta that he would not be a candidate for the presidency. These proposals received a tart refusal. Whereupon President Wilson told American citizens in Mexico to get out of the country, and ordered the consular representatives to aid them in doing so. That is the position at the time of writing. Meanwhile, it has been intimated to the Mexican government that if the American proposals are adopted, the American Government will be prepared to guarantee a Mexican loan. That is the key to the position. Huerta's last effort to raise money was a fizzle; he is short of funds; his mercenary soldiery will leave him for more profitable brigandage unless he pays them. Without American recognition he cannot raise a loan anywhere, for his government could give no guarantee. Without money he cannot establish his authority, and the country will drift deeper into irremediable anarchy. It seems to us, therefore, that he will either accede to President Wilson's proposals, or he will pick a quarrel with the United States, in order to consolidate domestic sentiment on his side. This means war. It would be no Boer war, but it would be bloody and costly. We are certain that the administration at Washington has no desire for military intervention, and is truly anxious to avoid actual war, but it is fully realized that the condition of anarchy and brigandage south of the Rio Grande must cease, and that unless decisive action is taken

now it will have to be taken more decisively and much more unpleasantly at a later date. So far we refuse to ridicule President Wilson's policy; on the contrary, he has shown the directness of purpose and courageous common-sense that we expect, but rarely get, from the representative of an intelligent democracy. The result just now is in the lap of the gods; we forbear from prophecy.

Mount Elliott.

This mining company, with its shares at £5½, at the time of writing, is an extraordinary example of the disregard of published information. At the meeting on December 3, 1912, the chairman, Mr. Herbert J. Hill, stated frankly that he did not know what was the probable life of the mine. At that time the ore reserve was given officially as 85,000 tons of 10 to 12% copper ore, plus 35,000 tons of probable ore of about the same grade. The shares were quoted at £8½. Since then the expectation that the rich orebody would persist in depth has been falsified and the ore reserve has been steadily depleted without a compensating development of fresh resources. All this is plain to anybody who reads the reports. On May 15 the manager stated clearly that no further tonnage of high-grade ore had been found, and his description of the bottom indicated that the orebodies were 'petering out.' Up to the end of March, 41,600 tons of ore had been extracted, and since the resumption of smelting in August a further 4000 tons has been used; so that about 75,000 tons remains. The yield of copper now is 10%, and the profit is £30 to £35 per ton of metal, so that about £250,000 can be estimated, but this profit will be diminished as the output dwindles, the expenses remaining the same. At the present time the position appears to be that the company has £160,000 in cash and about £160,000 of net profit in copper ore, so that the 160,000 shares are assured of a return of £2 per share. For this £2, and the slender

chances of further discovery, the shares are valued on the market at £5 $\frac{3}{4}$. It reminds us of the Mexico of El Oro at the time of the rupture with the Exploration Company, when the shares of that mine were quoted at £8 on the assurance of resources, in cash and ore, equal to about £4 per share. Another similarity exists in the fact that Paris is a large holder of the shares. Out of 160,000 shares, the French holdings of Mount Elliott amount to 120,000 shares, or three quarters.

Minerals Separation Process.

In our last issue we mentioned briefly that a decision had been given in the Montana court in favour of the plaintiffs in the case of Minerals Separation against James M. Hyde. The text of the judgment has now arrived in this country, and it is advisable, for the benefit of all interested in concentration by flotation, to review the scope and result of the litigation. Mr. Hyde had erected a plant to treat the zinc ore at the Butte & Superior mine by the Minerals Separation method, and refused to pay royalty, alleging that the patents were invalid owing to anticipation by former inventors. Minerals Separation brought an action for infringement. Before proceeding to detail, we may here remark that the lawsuit was commendably confined by both parties within reasonable limits of claim, and was not allowed to wander discursively into matters not strictly germane to the matter in hand, as is so often the case in patent proceedings. Furthermore, the judge showed an intelligent understanding of the subject, and his judgment exhibits a sympathetic grasp of technical science. The fact that he delayed expressing his opinion goes to prove that he wished to give special consideration to the matter under dispute. The plaintiffs claimed that the defendant was infringing United States patent 835,120 filed May 29, 1905, and granted to Messrs. Sulman, Picard, and Ballot. This patent is the same as British patent 7803

of 1905, and discloses the fact that if a very small and appropriate quantity of an oily substance, from 0.02 to 0.5% of the weight of the ore, is added to a pulp of water and finely pulverized ore, and the whole vigorously agitated and thereby thoroughly aerated by great and excess quantities of air, the metalliferous particles are oiled, and caused to adhere to the bubbles of air, thus forming a coherent and stable froth, which is easily removed. The action of the process is aided by heat, and the affinity of the oily substance for the metalliferous particles is made effective by the addition of acid. The defendant relied almost entirely on the anticipation constituted by the publication of Froment's British and Italian patents, the British patent being 12,778 of 1902. According to Froment's process, the crushed ore is mixed with water, oil, and carbonate of lime, the proportion of oil being from 1 to 3 $\frac{1}{2}$ % of the weight of the ore, according to its richness, and the carbonate of lime varying from 1 to 2 $\frac{1}{2}$ %. This mixture is agitated in order to bring the oil into perfect contact with the ore-particles, and is then delivered to a vessel into which a solution of sulphuric acid is introduced, slow stirring being done in order to prevent the ore from settling. The result of adding the acid is to generate gas from the carbonate of lime. The bubbles adhere to the oiled metallic particles, and carry them to the surface. Froment specifically states that the slime must be removed before his process is begun, while in the Minerals Separation process the slime is helpful and most easily recovered. The judge reviewed the two processes in detail, and pointed out the differences. In the first place, Minerals Separation discloses the use of minute quantities of oil, which renders the process different from anything previous. Second, the rapid agitation in Froment's case is intended to oil the surfaces of the metallic particles, and in Minerals Separation to make a permanent froth by beating excess quantities of

air into the pulp, and bringing the same air into repeated contact with the particles. The use of acid in the two processes is to fulfil two entirely separate functions. The buoyant gases are different and generated differently. In Froment's process each bubble of gas has little opportunity of effective work, as it rises and escapes rapidly, whereas the air in the Minerals Separation process is kept longer in contact; it is, in fact, caused to make a permanent froth. We have already mentioned the difference in the two processes as regards the retention or rejection of the slime. The judge viewed the case from a commercial point of view, and argued that, as the Minerals Separation process had been a practical success, it must be essentially an improvement on previous processes cited, which never went further than the suggestion or experimental stage. The utilization of slime, the smaller amount of oil employed, and the creation of a more lasting froth appealed to him as forming a distinct advance on anything done before. Without wishing in any way to prejudice the case if it should be carried to appeal, we desire to say that the judgment appears to be based on strong common-sense. The Minerals Separation process has, of course, been vastly improved since 1905 in many points of detail, but the patent of that year undoubtedly contains the basis of the principle upon which it is founded.

The American Institute.

After passing through a period of stress and strain, the American Institute of Mining Engineers has emerged strong and healthy, with every prospect of a career even more useful than that promised by the prosperous days of an earlier period. The last five years have been trying. Besides the scandal arising from the secretarial department, with the unpleasant controversy ensuing, the financial obligation created in characteristic fashion by Mr. Carnegie's gift was a burden almost too

heavy to be borne. Thanks to Mr. James Douglas and other loyal members of the Institute, this indebtedness, due on the land upon which the Engineering Societies building was erected, has been liquidated, and the Institute emerges now safe and sound. For the eventual good health of this important organization, one man is particularly responsible. Occasions and conditions arise in human affairs when an uncompromising directness of purpose is absolutely necessary. It is not pleasant to run counter to the amiable trend of social compromise, and it is not easy to maintain a consistent line of action among the conflicts of cliques and coteries. For his unflinching insistence on a re-organization of its management, the Institute owes a great debt to Mr. Christopher R. Corning. It owes more to him, we think, than to Mr. Andrew Carnegie. We hope never again to refer to the unpleasant subject, but we are impelled to give public recognition, as from a detached onlooker, to the splendid service done by Mr. Corning. It remains now to stop such further duplication as is inevitable from the contemporaneous existence of the Mining and Metallurgical Society of America. When this society was started, six years ago, it embodied a protest against the failure of the Institute to express the opinions of the profession on matters of public interest and the tendency to make the older society nondescript as to membership. We believe that Messrs. H. M. Chance and F. L. Garrison, with the other founders of the society, had an excellent purpose in view. They have accomplished that purpose in so far as the new society had the effect of stirring the Institute to a recognition of its responsibilities as the national organization of the mining and metallurgical professions. This having been done, it remains for the Society to commit polite suicide in favour of the Institute. No need exists for both; indeed, one only overlaps and interferes with the other. So long as both are endeavouring

to fulfil almost identical functions, neither will prosper. At present the Institute is incomparably the larger and more representative organization; the Society has failed to be representative, for it is an obvious impertinence for 250 men, however select, to think that they constitute the only mining engineers, metallurgists, or geologists fitted to belong to a national American society of their profession. The Society having failed to be representative, but having succeeded in awakening the Institute to a larger sense of its duties and responsibilities, it can now only serve as a menace and an irritant to the older organization. As the members of the Society are almost to a man also members of the Institute, the duplication serves no useful purpose, and should be amicably ended. The organizers of the Society can withdraw their bantling with the consciousness that it has not lived in vain, and they can join without hesitation in pulling an oar for the Institute, which is now clear of the rocks on which it nearly foundered.

If any doubts lingered as to the resuscitation of the premier mining organization of the American continent, they are removed by the unqualified success of the big meeting at Butte. The members forming part of the personnel of the copper industry of Montana have risen to the occasion magnificently, expressing their loyalty to the Institute by contributing an extraordinary series of papers descriptive of the varying phases of geology, mining, and metallurgy in the greatest of copper districts. Collectively these papers will fill many hundred pages and will form one of the most notable of the publications issued by the Institute. We note also a decided improvement in the method of issuing the papers, which are not only announced, or written, or promised, but actually printed in pamphlet form in advance of the meeting itself, so that discussion will be elicited under conditions favouring an intelligent exchange of ideas. We take these signs of improved vitality and management as good

auguries for the future prosperity and usefulness of a technical organization to which the profession not only in America, but abroad also, has reason to be grateful.

The Scab.

Among the exhibits from the recent strike on the Rand is a newspaper cutting containing a virulent attack on the non-union men or 'scabs' who took the place of the strikers. According to ultra-labour rhetoric the 'scab' is worse than Cain, more traitorous than Benedict Arnold, and more treacherous than Judas Iscariot. In fine, to quote from this printed diatribe, "there is no word in the English language that carries so much hatred, scorn, loathing, and contempt as the word 'scab.'" Yet the very same term is accepted by a large part of the community, whether at Johannesburg or in London, as merely a scurrilous synonym for the independent worker, for the man who refuses to obey the behests of the labour agitator, and is ready to fight the cause of decent people against the unintelligent tyranny of the unions. Here is a great gulf fixed, a separation of ideas so wide and so deep that it would seem as if no leap of logic could clear it and no effort of reason circumvent it. Great is the insularity of prejudice. In economic controversies, more particularly, the ordinary man "sees one fact so vividly that he is blind to all the other facts which alone explain the one he sees." Most men will justify the methods by which their money has been obtained, whether it be a burglar or a missionary. The average citizen will find ethical excuse for any source of pecuniary profit that enriches him, whether he be a book-maker or a publisher. Few are those intellectually so honest as to see the immorality of a process that gives them an unfair advantage in the competition with others; and this applies alike to the syndicalist and to the syndicate. Indeed, at the back of each man's mind is the idea that he has a right to protect himself, and still more to protect his

wife and children, in the struggle of life. The gladiatorial theory of existence persists, even if it be less loudly expressed than heretofore.

The word 'scab' is not new. It was used at Boston in 1834 when labour troubles, and the lawlessness incidental to them, astonished Chevalier, then on a visit to the United States. Then, as now, the industrial conflict was conducted amid gross insincerities. The employer who demanded an open labour-market and unrestricted competition among those whom he employed, was also eager for a protective tariff on his manufactures, and deeming unlimited competition suicidal to profitable business, strove to effect a combination with his more powerful competitors in order to obtain a monopoly. The 'union' among employees was highly objectionable, but the 'combine' among employers was essentially meritorious; so one side argued. On the other, the workers who expected the corporation to give legal security for the fulfilment of its contract with them, were unwilling to assume equal responsibilities, and whenever things went wrong evaded their agreement by allowing their union to disband. Amid these flagrant falsities, the 'scab' was intruded as a further irritant. When labour was trying to unite in self-protection, the 'scab' was the independent worker who refused to align himself with his fellows. He was also the hireling brought from outside the scene of local disturbance in order to break the back of the union. He was the Hessian that sold his service to the first bidder. Can you wonder that organized labour loathed him? He was a renegade to his class and a fatal leak in labour solidarity. Granted the right of the workers to organize in a union, it is obvious that those who stand outside the union, or come from other districts to assist the employer in breaking that union, are hateful. To deny the right of the labourer to organize, or to argue that labour-unions are iniquitous and should not be tolerated, is out of date; as an economic dictum it is as dead as the dodo; if

the employers and corporations may combine, why persist in the puerile protest against the unions? They are a fact, and a fact that has come to stay. The legal combination of capital is no more, and no less, inevitable than that of labour. Indeed, both kinds of combination are desirable, and they will be equally useful in the settlement of disagreements when one fatal defect has been corrected; we refer, of course, to the financial irresponsibility of unions and federations of labour. The corporation, which is nowadays a type of the large employer, is legally liable for breach of faith and financially responsible for the fulfilment of contracts, besides being vulnerable through the ownership of destructible property; the union, on the other hand, refuses to give bonds, is legally irresponsible, and becomes a dissolving unit whenever the acid of labour unrest corrodes the body politic. That lack of good faith chargeable to the labour-unions is the one fact that affords excuse for the corporate refusal to recognize them. That is the one legitimate reason for declining to treat with the officials of the union when not employees of the corporation. That is why the strike-breaker has come to be regarded by some people as a recruit in the ranks of social order and not a renegade to the cause of social justice.

Miner's Phthisis.

Some of our newspapers, prompted by letters from the strike leaders at Johannesburg, have made an appeal to the humane feelings of their readers. This argument for the miners on the Rand has not been ineffective, but it has been based largely on misinformation. We sympathize with the workers underground as much as anybody, and a great deal more than the two or three ignorant persons who have made themselves needlessly conspicuous in Parliament. Several points have been ignored. Miner's phthisis is not a germ disease, but a chronic affection of the lungs due

to mechanical irritation from minute particles of hard mineral, chiefly quartz or silica. Hence the alternative name, silicosis. Out of 3136 underground workers examined in 1911, no less than 31·6% were found to be affected. This means that 3600 men out of 24,000, or 15%, had phthisis. At that time 11,381 men were employed underground, out of a total working force of 24,171, so that about half were exposed to attack, allowing for those who might be affected by dust at the crushers. Naturally, the machine-drillers suffer most, the incidence of the disease among them being measured by a percentage of 48, and, what is worse, their average life before becoming absolutely incapacitated is only 9 years. After the drillers come the trammers, who inhale dust when loading from the chutes. A distressing feature, more prominent during the last five or six years, is the development of tuberculosis. All who are affected with miner's phthisis are not necessarily tubercular, but all are predisposed to tuberculosis. Therefore, two stages of disease are recognized: first pure silicosis, without tuberculosis, and then silicosis with tuberculosis superadded. The secondary development is more common now than formerly. Besides the inhalation of dust, it is probable that pulmonary catarrh, produced by blasting fumes, is a cause. Of the miners at work, as distinguished from those who have had to cease working, fully 10% of those who have silicosis have tuberculosis also. But it is known that the tubercular development ensues in most cases after the miner has ceased to work. No mention is made of the native workers, who outnumber the white miners in the ratio of 10 : 1, but they also, of course, are subject to phthisis. However, as their average term of service is only 8 months, they do not develop severe cases of silicosis, and those who incur the disease are likely to get rid of it on returning to their kraals, by living in the open air, without further exposure to the deadly dust. It might seem desirable, and

scientific, to separate those who have a communicable disease, such as tubercular phthisis, from those who are only phthisical, but it is a fact that tuberculosis in its milder forms is so general that isolation is impracticable. By existing law in the Transvaal a man known to have tuberculosis cannot work in the mines, and men who have not worked in phthisis mines, that is, on the Rand, but in non-phthisis mines, such as the coal mines at Vereeniging or the gold mines at Barberton, must submit to medical examination, and if either phthisical or weak-chested, they can be refused work underground. This indicates the beginning of an attempt to prevent the diffusion of disease among the workers. Indeed, the Mining Department, supported reluctantly at first, but willingly afterward, by both employers and employees, is making an earnest effort to combat the evil. It has been established that phthisis is a preventable disease. That is a dominant fact. For a long time no reliable data were available, and when they were available the disease had gained ground so far as to be beyond immediate control. It is due to the inhalation of dust, as we have stated. The first step, therefore, is to make no dust, or as little as possible. The next step is not to inhale dust. To accomplish this, the use of respirators was introduced, but they are largely futile, because the particles of quartz are so small as to pass the finest gauze. Then the application of water-sprays was introduced, and successfully. Even this does not suffice, because dust is inevitable after blasting, and that dust is so impalpable and invisible that it is conveyed by air currents. It became obvious that men emerging from a mine after blasting should ascend preferably by the down-cast shaft, filled with fresh air, and not by the up-cast, which is filled with air that is dust-laden. Where practicable the companies are compelled to use the down-cast as an exit. Indeed, ventilation is an increasingly important feature of mine sanitation on the Rand. At

one time only the rock-drillers were supposed to be exposed to silicosis ; they are the most affected, it is true, but anybody working in the mine may become phthisical, simply because the ventilating air-currents convey dust. Thus skip-men at the shaft's mouth have been victimized. On the other hand, it has been demonstrated that with systematic care it is possible to render the mine workings less dusty than the streets of a city. For instance, the air of the Paris or New York streets contains from 5 to 6 milligrammes of dust per cubic metre, but some of the Rand mines show, according to scientific test, less than this. The story is told of a mine reported by an inspector to be excessively dusty, whereupon an official investigation was made, only to find practically no trace of dust in the samples of air taken in that mine. Of course, the management had received a warning and had taken steps to spray the workings and to take other precautions. But the story is worth while as indicating that dust can be regulated, to the point of extinction, and, therefore, that, as we have said before, phthisis is preventable. At the present time about 1000 men annually are dying from phthisis, but this high mortality (the working force being 24,000) is largely the cumulative effect of past carelessness, and does not fairly represent the consequence of conditions as they exist today. The mortality will decrease rapidly to 200 or 300 per annum ; in other words, to a point where it will be less than is the case in other mining regions. As Mr. R. N. Kotzé, the Government Mining Engineer, has said, the miners "ought not to get phthisis," meaning thereby, we presume, that by the proper use of preventive measures, on the part of the men themselves and of the companies, the conditions creating this disease can be avoided. The time will come when the miner will be unable to get it, except by wilfulness, in order to obtain compensation. We note with pleasure that Colonel W. C. Gorgas, the chief sanitary officer of the

Panama Canal Commission, has been engaged by the Transvaal Chamber of Mines to visit the Rand, to investigate the conditions obtaining there, and to give advice. Nothing should be left undone to remedy the evil. Further earnest effort to do so must convince the workers of the good faith of their employers, and, in so far as it does that, it should remove one of the factors conducing to economic unrest.

Mining : A basic industry.

Those who are interested in mining and happen to live in a financial centre like London are apt at times to confuse cause and effect, to put the cart before the horse, and to assume that the function of mining is to furnish counters for a gamble in shares. Judging from such discussions as one hears in public places and in the daily press, it might be inferred that the underlying purpose of world-wide operations in mines was to afford scope for share-dealings and financial legerdemain among the excellent people who congregate daily in the environs of the Bank. A dull market is accepted as a sign that mining is languishing, and when the community becomes suddenly crazed by an excitement on the Stock Exchange it is inferred that a basic industry is booming. This, of course, represents a manifest perversion of ideas. The Mediterranean no more exists as a frame for Monte Carlo than does the industry of mining for the pastime of Throgmorton Street. Share-dealing is a frill, gambling is but the froth, and brokerage but a bubble on the great stream of human activity originating from the exploitation of mineral deposits. Mining, not the funny business and *vernukerij* incidental to one phase of it, is the foundation of the complicated mode of living we call civilization. Remove the metals and the underpinning of civilization is withdrawn. The material basis for the health, comfort, and convenience of mankind is metallic. It

is not necessary to argue the point. We have but to think of the uses to which we put iron, copper, tin, lead, zinc, silver, and gold to realize how the web and woof of the modern world is spun with metallic threads. And yet there be those who fear that mining is languishing and that it will become a decaying industry unless the 'general public' can be induced to come into the menagerie where bulls and bears, lambs and guinea pigs, and queer fish generally, are disporting themselves more or less lugubriously. It is true money is needed in mining, and when money is scarce, by reason of a malaise such as afflicts the bourses of Europe today, it is difficult to start large undertakings or to obtain funds for mineral exploration on a big scale. But that condition cannot endure. The world may do for a while with a diminished supply of lead or copper, tin or zinc, gold or silver; but not for long. It can suffer the loss of its stock exchanges before it can dispense with the metals on which its transport is effected, by which it communicates, with which it constructs, and by means of which it expresses its manifold energies. The essential function of the metals is illustrated by comparison with diamonds. The latter afford scope for a large and highly profitable industry, but it is an industry in no way essential. If the supply of diamonds were to cease, a luxury would be unavailable, a number of fair ladies and an equal number of foolish men would be annoyed, but the well-being of the world at large would not suffer one jot. Incidentally the cessation would cause excited performances on the diamond market, but it would be an evanescent splash as compared with the cessation of production in the useful metals. That contingency we do not fear, however much the broker and the jobber may imagine a vain thing, or the financial press rage furiously. Sooner or later we come to bedrock; the bedrock of the modern way of living is hard metal, not diamantiferous gravel nor the quick-

sand of make-believe. While the share markets are depressed, no new issues of paper can be made successfully, but all the time that brokers, jobbers, and promoters are insisting that business is dead, the search for metals is proceeding in every corner of the globe. A silver-lead discovery is made in the Argentine, gold is found in the Congo Free State, lodes of precious metal are uncovered in Ontario, a huge deposit of silver, lead, zinc, and copper is disclosed in Burma, fresh placers are announced from Alaska. The law of supply and demand is not atrophied. Modern civilization craves metals for manifold use; it must have them at any price. If speculation on the exchanges ceases to stimulate the search for metals as a preliminary to dealings in scrip, then the persistent demands of world-wide industry will cause the price of metals to rise to a point where the production of them becomes increasingly profitable without regard to the collateral gain incidental to share-dealing. Similarly, betting is linked with horse-racing; but behind both the gamble and the pastime is the necessity for breeding horses as a means of power applicable to the requirements of human life. The breeding of fine horses may be stimulated by the incidental sport and gain to be derived from racing; so also the winning of metals for daily use may receive a fillip from the fact that such exploitation can be rendered increasingly and more quickly profitable by the speculation in shares incidental to joint-stock company-ownership. But the share-market is not the prime motive nor even the main support of the mining industry; that has its foundation in the necessities of civilization. Those necessities were never more insistent than they are now; even wars and the rumours of wars cannot more than check the demand for metals; and that demand if checked for a while must gather a cumulative force that will give fresh life to the basic industry of mining.

ROYAL SCHOOL OF MINES

The Association.—A meeting of old students of the Royal School of Mines was held at the United Service Club, Calcutta, on August 18, 1913, to discuss the formation of the Royal School of Mines Old Students' Association. There were present Messrs. H. G. Graves, K. A. K. Hallows, H. C. Jones, J. J. A. Page, A. L. Shrager, H. Walker, and Lt.-Col. F. C. Hughes.

Lt.-Col. Hughes was elected to the chair, and Mr. H. C. Jones as recorder of the meeting.

Mr. Frank Merricks' letter of July 11 announcing the formation of the R.S.M. Old Students' Association, and the report of the meeting held in London on July 22 to inaugurate the Association were read and discussed.

All present agreed to become members, and to subscribe two or more years' subscriptions in advance.

Mr. Gordon Duff, who was unable to be present, wrote expressing his pleasure at the formation of the Association, and desired to have his name put down as a life-member.

The following subscriptions were promised: H. G. Graves, five guineas as a donation, and ten years' subscriptions in advance, Lt.-Col. F. C. Hughes, H. Walker, J. J. A. Page, K. A. K. Hallows, and H. C. Jones each two years' subscriptions in advance, and A. L. Shrager, five years' subscriptions in advance.

The following suggestions were adopted, and are to be forwarded to the Committee at home for consideration:

1. That whenever possible, notices of elections and other important matters should be communicated to foreign members in sufficient time to give them an opportunity to express their views.
2. That if possible, a room or address in London should be arranged for, where

foreign members of the Association could meet or communicate with other members, or at any rate meet the Honorary Secretary or other members of the Committee of the Association.

Coaching.—Touching this hotly debated subject, we referred in our last issue to the junior staff as being "both inefficient and underpaid." It is inefficient largely because it is underpaid, and also because it is undermanned. But this must not be taken to mean that all the junior staff is inefficient, for any cause; on the contrary, the junior staff includes several instructors without whom the School would be poor indeed. We acknowledge the good work they are doing, and urge the authorities to recognize the further fact that without the aid of such efficient assistants the professors, however eminent or learned, cannot make much headway.

On another page we publish a letter from Mr. F. C. Goodwin. This states the other side of the case.

Mining Class.—We understand that an effort is being made to co-operate with the Camborne School in the opportunities afforded for instruction at the King Edward tin mine, which is near Camborne, and under the charge of Mr. J. C. Shepherd. During July and August a party of six R.S.M. students was afforded the chance to learn something about typical underground work, such as driving, stoping, and timbering. During the process of the experiment, visits of inspection were made by Prof. Frecheville and Mr. S. J. Truscott. While the commercial element may be lacking in such mine-work as this, it affords an opportunity for giving first-year students an insight into the meaning of mining terms and operations, enabling them thereby better to assimilate the instruction of the lecture-room.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres.

LIMA.

Borax.—Of the non-metallic minerals of Peru that are of economic value, borax is likely to become of considerable importance through the operations of the Borax Consolidated in the department of Arequipa. Due chiefly to lack of transport facilities the yearly production has been falling off; in 1911 over 1923 metric tons were exported, while the output for 1912 is stated to have been 1475 tons. The extensive deposits controlled by the company are to be exploited actively in a short time, in view of the recent concession granted by the Government. The Borax Consolidated

Guano.—While a declining industry, due to heavy exportation in past years and the reckless manner in which extraction had been carried on, the guano deposits continue to be a profitable business. The Compañía Administradora del Guano Limitada, a local company, which has been in operation for four years, shows in its last report a total profit of £13,980, resulting from the sale of 24,350 tons of high-grade guano (9·18% nitrogen). The Peruvian consumers require at least 40,000 tons annually, which tonnage has not been attained by the company although the last annual report indicates a demand of 105,771



MOROCOCHA: NATIVIDAD AND SAN FRANCISCO SHAFTS.

Ltd. agrees to build a railway from the borax fields to the city of Arequipa, and erect calcining furnaces either in the city mentioned or on the property. The company will not be levied taxes for 18 years, commencing from the date it begins to export at the rate of 20,000 tons of calcined borax. The railroad, or, if not feasible, an aerial tramway, is to be used; it will be about 42 kilometres long, and at least £200,000 must be spent in the construction of it and of the calcining plant, which latter must be of sufficient capacity to handle at least 40,000 tons annually. The concession conveys other 'grants' of minor importance.

tons; the directors state their belief that the increased demand is due principally to the desire of the various users of the fertilizer to secure a full supply by ordering more than they require, knowing that only a portion of the order can be filled. On a paid-up capital of £7500 a dividend of £900 was paid last year. The Peruvian Corporation is stated to ship nearly 80,000 tons annually, but during the recent months some difficulties were encountered through the Government restricting their production.

Coal.—The coalfields of Peru have often been brought forward to attract capital in view of the increasing demand for coal on the West

Coast. It has been stated that about 1,500,000 tons is consumed annually, of which the greater proportion is imported. The opening of the Panama Canal will tend to increase consumption by reason of the additional steamers that will handle freights. Up to the present no coal from the interior has found its way to the Peruvian coast, on account of the lack of transport or high freight tariffs where railroads exist. The Peruvian Corporation has recently reduced its tariff from 5 centavos to 3½ centavos per kilometre-ton. A recent Government decree has withdrawn the Jatunhuasi coalfields from 'denouncement.' This district covers seams of good bituminous coal that makes excellent coke; it has been opened-up superficially and small shipments of coke have been made. The nearest railroad (Central Railway of Peru), is about 42 miles distant. At present a preliminary survey for an aerial tram-line (capacity 40 tons per hour and about 24 miles long) to connect with a railroad point is under way, partly for account of the Government, in view of the recent examination of the district. The coal will be coked and used at the Casapalca smelter, the Backus & Johnston Co. having entered into an arrangement with the Government, a lower cost and more regular supply being the incentive. The successful exploitation of this coal will naturally stimulate interest in other fields, unfortunately not so favourably located as regards communication with the coast. This is along the lines of the bill presented to Congress for the formation of a large company to explore the coalfields with the assistance of the Government. The Cerro de Pasco Co.'s coal mines produced 299,800 tons (metric) in 1911, this being used either as fuel or washed and coked. The total output given for Peru during the same period was 324,000 tons (metric), so that the production of other districts is a negligible figure. For 1912 the company's output is given as 268,000 tons. The value of the coal produced has been stated as £194,155 (see the *Estadística Minera del Peru en 1911*), and the value of the coal and coke imported, 83,102 tons, is given as £166,203.

The coalfields (anthracite) near Huallanca are to be explored now that the concession of a railroad, from the port of Supe to that district has been granted and foreign capital interested in the project. The Oyon region, which has occasionally furnished coke for the Huauracaca smelter, near Cerro de Pasco, is likely to be reached by a railroad from Sayan, the present terminus of the North

Western Railroad, locally called the Ancon-Huacho line. This coal is bituminous and makes good coke.

Oil.—In my last letter, mention was made of the petroleum output for 1912, "about 250,000 metric tons." This figure is too high according to the British Minister's report, which states 214,947 metric tons. The fifth annual report of the Lobitos Oil Fields, Ltd., was made on May 27 in London. The most interesting features were the declaration of the company's first dividend at 10% less income tax (£37,664), and the formation of a reserve fund, the sum of £10,000 having been set aside. The production for 1912 was 78,273 tons from 105 producing wells, the tonnage increase over 1911 being 26,101 tons; 41,686 ft. was drilled in 1912 against 28,166 ft. in 1911. The prospects for 1913 appear to be an improvement over 1912, as regards production, better prices, and opening-up new ground. The examination of oil-ground near Chimbote has not shown the results expected, but drilling may be done.

Gold.—The "apparently wonderful gold deposit," mentioned in my last letter, has not proved to be what was so optimistically expected. The average of \$6 gold per cubic yard has not been confirmed by the examination made after £14,000 had been paid for the property. Recent sampling showed an average of 40 cents per cu. yd., taken from the same tunnels and pits as the first previous samplings, no new work having been done. The difference in the gold contents quoted has been due to assaying the screened samples (through 8 mesh) on the property as compared to sending samples through the mail. It has been stated that gold chloride and shavings were used to give the high results, although there exist small patches where high pannings were obtained, but such spots are of minor importance. It appears that although the first pannings showed no 'colour' the latter high assays (of the pannings) were attributed to the gold possibly occurring in some unknown combination, other than 'free.' It was known early in the sampling that the coarse gravel contained no gold, hence only the screened material was assayed. About £16,000 was spent by the Ambo Gold Mines Co.; and £1000, on adjoining property, by the Huanuco Gold Mines Syndicate, a local company. If the Amazon Pacific Railroad is built there may be hopes of doing something with the deposit, despite the unfortunate boom due to generous 'salting.'

Copper.—The Cerro de Pasco smelter is

operating only on 40% capacity, producing 3,500,000 pounds of copper monthly. Lack of coke is a serious draw-back to a larger output. The Dwight-Lloyd sintering experiments have proved successful and five additional 50-ton sinterers will soon be installed. It has been found practicable to sinter 60 tons of fine per 24 hours without the addition of lime. In the Morococha district operations have been handicapped from lack of labour. The miners are gradually returning from their annual harvesting, so that activities should be in full swing by the close of August. The San Francisco shaft of the Morococha Mining Company, which consists of two hoisting

will be mined. The Central Railroad of Peru is arranging to facilitate handling ore by installing a yard above Anticona (at an altitude of 16,600 ft. above sea-level), so that direct ore-trains, either for Casapalca or Cerro de Pasco, can be made up advantageously and lessen transport difficulties.

The new hydro-electric plant of the Backus & Johnston Co., below Casapalca, is expected to be in operation by the middle of August, although it will not be in full swing until several months thereafter. A transmission line will be run to Morococha, so that the company's mines will be able to use electric power to replace the more expensive coal-burning



CASAPALCA SMELTER, as seen from the train.

compartments and a pump and manway, will be sunk 350 ft., that is, to the 500-ft. level, at which point the Carlos Reynaldo cross-cut will be intersected. The property has not been developed as extensively as the adjoining Natividad mine; it covers nine veins, of which three are said to carry profitable ore. The Natividad shaft will be sunk an additional 3 feet (to the 800-ft. level) as soon as the labour situation has improved. Ample pumping arrangements have been provided in the two 1000-gal. 'sinker' already installed; the shaft will have two hoisting compartments, with pump and manway, below the 500-ft. level; the enlarged section will be carried to the surface at a later date. At present exploitation is being done at 200, 300, 400 ft., and in a small way from the 500-ft. level. A contract has been made with an adjoining property whereby two of the Natividad veins (three have been exploited up to the present)

plants. Meanwhile oil-burners are to be used at the Natividad shaft, decreasing the coal consumption. The two 96 by 150 in. barrel-converters at Casapalca are almost installed and are expected to produce 15 tons of copper each per 12 hours; for the present one converter will be run on a 12-hour shift until both blast-furnaces are in operation. The old water-jacket, which has done exceptionally good work, will be soon shut-down to permit changing the top and to make flue-connections, a matter of three to four weeks. The company has lately acquired a lime quarry, about 60 kilometres by rail in the direction of Oroya, but recent work has shown the ores to be self-fluxing, so that little lime has been required.

The operations of the Sociedad Cuiyre de Huaron, near Hualiday, are proceeding slowly. It is stated that nearly 100,000 tons of 12% copper ore are blocked out. The erection of a smelter is under advisement.

The Huallance copper mines have been optioned by the concessionaires of the railroad already mentioned. The mines have been producers for some years, shipping high-grade copper-silver ores and lixiviating the low-grade mineral. The ores occur in bunches in quartzite and slate.

Ferrobamba has not been actively developed for almost a year. Advices from Arequipa indicate that all work has been stopped, but word from London states that provided the treatment problem is solved, activities will be continued; it appears that experimental tests have been made, including direct smelting and flotation.

Lead.—Lead mining is likely to be active in view of the high price of the metal. The Yanamina Mining Co., operating at Vinchos, near Cerro de Pasco, will soon erect a furnace to treat 20 tons of silver-lead ores per day. The company controls mines and extensive dumps, also coal properties.

MELBOURNE.

Gold Mining in Victoria.—It is not often that a great newspaper is found decrying one of the most important industries, but this has been seen in Victoria, where one of the dailies has thought fit to advise the State to shut-down on the gold-mining industry. *The Age* has never been very kindly disposed to mining even when it knew that many of the iron foundries, for which it claimed the protection of a heavy tariff, could have no existence if the mines ceased to become their customers. Anyway, the whole point has been raised whether the gold-mining industry is practically moribund. Unfortunately, there is too much truth in the statement, judging from the appearance of affairs to-day. The returns for Victoria can be set out as follows:

Period	Oz.
1851 to 1900.....	64,346,612
1905.....	810,050
1906.....	834,775
1907.....	754,270
1908.....	721,220
1909.....	702,221
1910.....	609,998
1911.....	542,074
1912.....	500,000

In 1903 dividends amounted to over £600,000, whereas now they have fallen by fully 50%. Therefore, not only has work become less profitable, but people have got tired of paying money into mines where the chance of getting a return is somewhat remote. Added to this, the cost of labour has gone up tremendously,

due, first of all, to the higher wage that has to be paid, and next to the deliberate inefficiency of the worker himself. The miner is led by the labour agitator, who, like his prototype, the walking delegate of the United States, believes in as little work and as much pay as can be extracted from the employer. The contract system has now practically ceased to exist in Victoria; no single company appears inclined to fight for the introduction of that system, and so calls are heavy and results disappointing. At present, the once famous Ballarat district is a mere shadow of its former self, though there are in East Ballarat huge lodes that ought to pay well, if worked on a proper scale and with adequate capital. The 'deep leads' languish, what with low results, high costs, and the chicanery practised by some of the leaders of that branch of the industry. Bendigo has plenty of scope for capital, but public support is being withheld because of the devious methods of the sharedealer at that centre. He is too close to the mines and too friendly with the managers for the outsider to get a square deal. So capital is shy, and local people don't like it. Still this does not say that Victorian mining is played out. There are plenty of deep leads to be explored and to be exploited. There is a big region in the mountainous country of southeastern Victoria to be explored. But men with cleaner methods will have to take the lead, and the State will have to agree to aid, by assisting in boring for the deep leads and in helping the prospector to get into the mountain recesses. Still, as it is now accepted that the superficial deposits are worked out, that in the Ballarat district 1000 ft. in depth pretty well sees the limit of profitable ore, and that Bendigo ceases to search for gold below 3500 ft. because of the poverty of the ore at that depth, it is certain that diminished returns from the industry are inevitable unless deep-lead mining can be made cheaper and more honesty is infused into the management of both quartz and alluvial properties.

Queensland.—The strike in the copper region in North Queensland is at an end, and the mines have been permitted to resume work. The fight here, too, was over the contract system, and as the companies co-operated, they were enabled to put up a fairly strong front. A hand in the deal was taken by the Queensland authorities, who called a compulsory conference that ended in a reasonable working agreement being reached. Still, a good deal of loss has been entailed, and it is almost certain that it will be some time before the com-

panies succeed in manning the claims to their old strength. During the term of partial idleness, a lot of repairing and development work was done with the labour available, so that the mines will resume smelting in a better position than many folk thought possible. No new discoveries of importance have been made, but some of the outside claims are opening up good bodies of ore. The railway to the Mount Cuthbert group from Cloncurry should be finished by the State in about nine months. Then that block of mines ought to assume proper form, as all they need is communication and cheap freight. Beyond these lies the Mount Oxide mine, whose prospects now tremble in the financial balance. An option over it was secured by a London group, with the Consolidated Gold Fields as the central figure, but on July 31 the news was conveyed to the Sydney owners that London did not want the property except on better terms than having to put up £150,000 working capital and having to give 200,000 paid-up shares out of a company of £475,000. The Sydney people would not concede the terms asked, and so there has been a bustle to get fresh capital. As a matter of fact, Mr. Gerald Williams reports that the mine has improved out of sight since he took it in hand. He gives the reserves as 50,000 tons of 24% copper ore, and 60,000 tons of 10% ore, most of which is proved. To Australians the real trouble with the property is that it lies 75 miles distant from Mount Cuthbert, and that a large sum may have to be spent to provide cheap transport, but if the present company could do it the best policy it could adopt would be to cut out all proposals for outside capital, open up another level below 300 ft. to find out if the copper glance lives down, and then arrange for its smelting plant.

Great Cobar.—Mr. Pellew-Harvey, one of the directors of the Great Cobar, has been spending some time on the property. His coming was as quiet as that of a mouse. His doings as secret as those of the sand mole of the Australian desert. What he thought of the mine was not known till shares jumped, and then came the news that a good report had been dispatched to the directors. On this side of the world Mr. Pellew-Harvey's doings have been followed most intently. What has leaked out is that he has in his eye the reorganization of the staff. Word has gone round that the copper contents of the ore in the bottom of the mine have improved, and that the returns, with the aid of the flotation process, are on the mend. How far these

rumours will be verified will be seen when Mr. Pellew-Harvey's report finds the light, but it must be confessed that people on this side do not build much on the optimistic expectations. The mine is being got into better trim underground, and it is certain now that the reports respecting the creep were exaggerated.

The Broken Hill district is demonstrating its position as the main-stay of Australian metal mining. The next three months promise to see important developments. In metallurgical science such progress is being made with the processes for the selective flotation of lead and zinc sulphides in the slime from the mills that some of the big mines have decided to build plants for that purpose. In this connection it is understood that the Minerals Separation Co. after all has bought the Lyster process, so that it now is the proprietor of both the Lyster and the Owen processes, leaving the Bradford process in the hands of its owners. As the Minerals Separation and the Amalgamated Zinc companies co-operate over these processes, the outside world will have to pay royalty to either the one or the other. Developments at the South mine show that a distinct ore-shoot lies west of the main lode. At the Block 10, the continuation of the orebody cut by the Sulphide Corporation on the boundary of the two mines has been met, so it is now alleged that at least 32s. 6d. per share is in sight. At the north end of the field, the British company at 1100 ft. is now driving to prove the downward continuation of the ore being developed near Thompson's shaft, and at the North mine the lode should be cut before this letter reaches London. The half-yearly dividends of the South and North companies are expected any day, and with their financial position so strong, the late rate of 6s. and 2s. respectively ought to be maintained, despite the fall in the price of zinc.

TORONTO.

Porcupine.—The work of enlarging the Dome mill for the addition of 40 stamps is well under way. All the required machinery has been ordered, and it is anticipated that the additional battery will be in operation early in 1914, increasing the capacity from 370 tons to 650 tons per day. An innovation will be introduced in the process of ore treatment: in place of all residue from the mill being passed to the slime treatment, six sand-leaching vats will be added, to classify the sand and slime. The last four-weekly statement of the Hollinger, covering the period ending July 15, was of a highly satisfactory character, showing a

profit of \$129,146. The total profit from January 1 to July 15 was \$851,667, or at the rate of 48% per annum on the outstanding capital. A total of 10,056 tons of ore was treated during the 4-weeks period, the average value being \$19'70 per ton. The extraction had increased from 95 to 96'5%. Work has been started on No. 44 vein, which was not included in the estimate of ore reserves. It has been trenched for about 80 ft. upon the surface, and sampling shows an average gold content of about \$60 per ton over a width of 15 in. Since the statement was given out, No. 1 vein, which had dipped out of a winze put down from the 300-ft. level for 125 ft., has been picked up by cross-cutting on the 425-ft. level, where it appears as good as on the upper levels. The McIntyre has struck the vein in No. 5 shaft, 45 ft. below the 200-ft. level. The ore from this working will be taken to the new mill by an aerial tramway to be built across the lake. A bond issue of \$250,000 has been arranged to provide funds for meeting indebtedness and paying for the enlargement of the mill. On August 25 the shareholders of the Dome Lake ratified the increase of the capitalization from \$500,000 to \$750,000, but for the present withheld their consent to a proposal to issue \$100,000 of the additional shares at a heavy discount. Considerable dissatisfaction with the management was expressed and more complete information concerning the condition of the mine demanded. Negotiations are pending for the sale of the Hollinger Reserve properties to the Lewishohn interests of New York, but details as to the terms have not been fully settled. The Hughes is sinking to the 400-ft. level, the drifts at 300 ft. showing satisfactory results. If the showing continues good at the greater depth, the company will proceed with the erection of a mill.

Kirkland Lake.—The Foster properties have been taken over by the Tough-Oakes Gold Mines, with an authorized capital of \$3,000,000, the principal officials being Clement A. Foster, president and managing director; Harry Oakes, vice-president; and Edwin W. Kearney, secretary-treasurer. It is proposed to raise \$200,000 by the sale of stock to finance the construction of a larger mill and continued development. The total gold production to date amounts to \$46,747, in addition to which the ore contained silver to the value of \$2060. The average gold content of the 104 tons treated was 23'37 oz. At the Teck-Hughes, the vein, which has been cut at the 100-ft. level, shows as well as on the

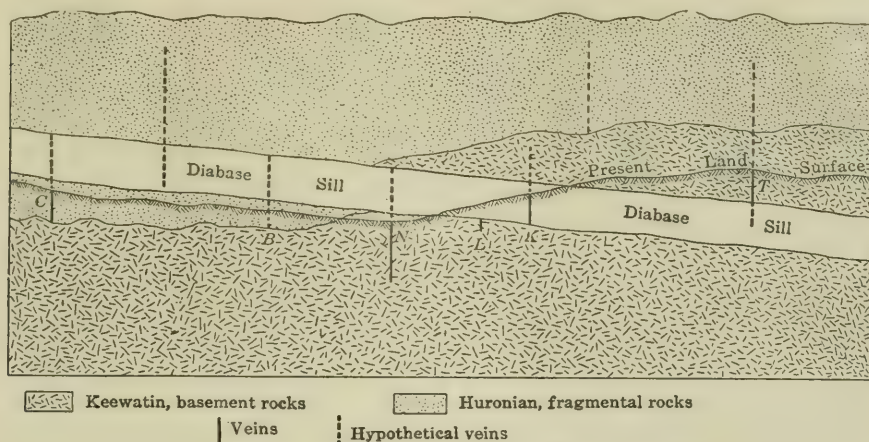
surface, carrying 14 in. of high-grade ore with considerable free gold. A winze is being put down to the 200-ft. level. The Right of Way, of Cobalt, has taken an option on the Flynn claims, seven in number, lying south of the Tough-Oakes.

Cobalt.—Public confidence has been considerably weakened by the circumstances connected with the passing of the usual monthly bonus by the Crown Reserve. Payments by this company have for some time been on a 60% basis, a bonus of 3% being given with the regular 2% monthly dividend. Some weeks ago heavy liquidations began without any apparent reason, large blocks of the stock being thrown on the market for anything they would bring. The price, of course, began falling, and the shares, which five months ago had reached the record price of \$4, dropped to a little more than half that figure. The true inwardness of the slump was not revealed until the meeting of the directors on August 11, when it was announced that on account of diminished ore reserves and the pinching out of the Carson vein, it had been decided to discontinue the bonus. The directors denied having availed themselves of inside information or disposed of any of their holdings, but the fact remains that a knowledge of the actual condition of the mine must have leaked out somehow, and been utilized by large holders of the stock. The incident has acted as a damper on a market already depressed, and latterly transactions have been very limited. The Beaver is cutting a station for a new level at 800 ft., which is the deepest point attained in the district. At 700 ft. No. 5 vein shows 4 in. of ore running over 3000 oz. per ton, and a cross-cut is being run to pick up the vein at the lower level. At the Cobalt Lake a plan of operations has been decided upon for the exploration of an area of several acres at the north end of the property. The work will be done from the old shaft, No. 4, on the east side of the lake. The Nipissing made a record shipment of bullion on August 19, consisting of 212 bars of silver containing a total of 254,400 fine ounces, valued at \$150,096. This was the result of seven days' work at the high-grade mill. The ore came from a recent rich discovery on the 300-ft. level, from which large quantities of ore are being taken. The Cochrane, which has taken out some high-grade ore at and above the 200-ft. level, has found the ore-shoots very short, and is adopting a policy of deep mining. The shaft is to be put down from 200 ft. to reach the diabase formation, which in this part of the district

underlies the Keewatin at about 600 ft. Levels will then be run to tap the main vein. The York-Ontario has picked up a rich ore-shoot from which high-grade ore is being taken. The output of La Rose for July was 226,626 oz. The total revenue was \$136,815, and the profit \$81,413. The cash surplus was \$1,418,404, and the value of outstanding shipments and ore ready for shipment \$299,411.

Geological Congress.—The event of August in Ontario was the meeting of the 12th International Geological Congress at Toronto, from August 7 to August 14, the meeting proper being preceded by a number of excursions to the Canadian districts of most interest, and followed by similar excursions of

J. F. Kemp, Malcolm MacLaren, and Paul Knesch, the last being especially interesting since Dr. Knesch concludes from the microscopic study of the sulphides of copper that bornite and chalcocite are always secondary. Since L. C. Graton, in America, after studying over 500 specimens has come to the conclusion that chalcocite is nearly always primary, the question is obviously open for further discussion. Mr. W. H. Emmons, who is professor at the University of Minnesota, has done some of the most suggestive of the recent work on the laboratory study of the chemistry of ore deposition. The discussion of the classification of pre-Cambrian rocks exhibited the fact that there exist as many shades of opinion as there are students of the



GEOLOGICAL SECTION OF COBALT DEPOSITS.

which one carried its members as far as the Yukon. Nearly 1000 geologists and mining engineers were registered as members of the Congress, and over 400 were in attendance. The central theme of the Congress was Coal Resources, the results of their study by those of greatest authority concerning each country being embodied in three quarto volumes. But little attention was paid to this topic, however, in the technical sessions, the afternoon set aside for that purpose being, because of a too indulgent chairman, largely monopolized by an enthusiast whose remarks had little bearing on the assigned topic. At the later session the speakers were restricted to a reasonable time in the presentation of their ideas, and excellent discussions resulted, especially on the persistence of ore in depth and the classification of the pre-Cambrian rocks. The principal papers at the former discussion were by

subject, but in exciting general interest it was the most successful session of the Congress. Two sessions, or sometimes more, were held each day, and a great variety of subjects, such as tectonics, glacial geology, etc., were discussed. Most of the members heartily appreciated the opportunities for social intercourse afforded by the Congress. The headquarters were at the University of Toronto, which had kindly put its dormitories and dining-halls at the disposal of the visitors, with the result that there was ample opportunity for the quadrangle life that is one of the most valuable features of University residence. The meeting finally closed with a special convocation of the University of Toronto, at which honorary degrees were conferred upon Richard Beck, T. Chernyshev, J. J. Sederholm, T. C. Chamberlin, Willet G. Miller, Pierre Termier, and A. Strahan.

JOHANNESBURG.

The Strike and After.—Common-sense ultimately proved a stronger force than the vaunting ambition of agitators, and the state of tension came to an end on August 1, when the Trades' Union chiefs capitulated to a firm Government supported by public opinion. The labour leaders intoxicated with power had threatened a general strike throughout the country, as they considered that their extravagant demands had not been sufficiently met, but the Government at once made elaborate arrangements to repatriate every native on the mines, several thousand armed and mounted burghers holding themselves in readiness to proceed on escort duty at a moment's notice, and the general body of the people on the Rand, and indeed throughout the Union, began to evince such unmistakable signs of resentment against labour methods and labour tyranny, that the strike magnates, seeing that their absurd methods of intimidation were useless as a means of coercing either Government or public or of further misleading the workers, gave up their bluff and threw up their hands. Thus the fear of the closing-down of all the mines for six months and the dread of resulting ruin are no longer with us. The workers are now experiencing a taste of what might have been. Owing to the cessation of recruiting, necessitated by the inadvisability of increasing the number of natives on the Rand while a grave crisis was pending, the leakage of time-expired indentured boys has not been made good, and thousands of others, who in normal times would have re-engaged, were frightened out of the country, with the result that a serious labour shortage now exists, and is likely for some time to exist, compelling in many cases, the cessation of work in portions of the mines, and in all cases much restriction of activity, with the throwing out of employment of many miners. Hundreds of these men have shaken from off their feet the dust of a country where they are not allowed to work in peace. Had the Government granted all the demands of the strikers, mining costs would have risen, at a modest estimate, 2s. 6d. per ton crushed, an increase which would lead to the closing-down of many low-grade properties, the discharge of thousands of white workers, the infliction of great loss on dependent trades, and the curtailment of the wages bill to the extent of £4,000,000 or £5,000,000. In South Africa mining is at present the one important industry, and anything that hits it hits everybody. Even now the liberal concessions that the Government

and the mine-owners have granted, and the further ones they are about to grant, will cause a rise of 1s. per ton in working costs, an amount not serious to a rich mine but one with dire possibilities for a poor mine. There seems little likelihood of a recurrence of trouble in the immediate future; beyond that it would be unwise to attempt to foreshadow the course of events.

The Transvaal Gold Mining Estates is a company that has come into notice a good deal of late, and is considered to have a bright future before it. Its property comprises numerous farms and claims scattered over the mountainous district of Pilgrims Rest, in the eastern Transvaal, and it operates several mines, one main central and two small outlying reduction works. It was in this district that diggers to the number of close on 2000 took out £500,000 of alluvial gold in the early 'seventies, and in the late 'seventies the auriferous lodes were discovered and worked. These lodes, in the great majority of cases, occur as interbedded ore-sheets, the ore being a loose dirty white honeycombed quartz containing much soft ferruginous matter. The gold exists in a very fine state of division and is rarely, if ever, visible to the naked eye. The two principal lodes are named the Beta and the Theta; and they lie in the dolomite 200 ft. apart. The Beta lode has an average thickness of 10 inches and the Theta 20 in. Their general dip is westward at the gentle angle of 4°, but sometimes a disturbance in the strata will tilt them at a steep angle. In some of the mines the enclosing formation is so soft as to require the use of large quantities of timber; in others, it is hard and solid, so that no timber is needed. In the flat portions both long-wall and pillar-and-stall methods of working are employed, and in the steeply inclined places both underhand and overhand stoping are practised. The lode is taken out clean, an 18-in. hole loaded with one cartridge being sufficient to loosen it and allow of its being removed by the pick. It may sound almost incredible, but flat stopes as narrow as 12 in. have been successfully worked for considerable periods. During the year ending March 31, 1913, the company made a net working profit of £277,415, as against one of £205,104 during the previous year, and the dividend rose from 27½ to 37½%, the highest ever paid. In all, 172,759 tons were crushed, yielding 54s. 4d. per ton, at a cost of 32s. 2d. and a profit of 22s. 2d. per ton. The ore reserves are as given in the table on the next page:

Section	Stamps	Tonnage	Dwt.
Central	60	385,547	14'2
Vaalhoek	10	40,892	10'4
Elandsdrift	5	30,210	15'0

When the ore is highly pyritic it is troublesome to treat, but, as a rule, little difficulty is experienced. At the Vaalhoek mine the ore is so refractory that the consumption of cyanide reaches the high figure of 5'54 lb. per ton treated. The company has an electric power station on the Blyde river, 20 miles from the central works, in which are installed 3 turbines each capable of generating 950 horse-power. This station cost £72,000, but the expenditure has been handsomely justified

be not less than 15 years and it may extend to 25 years.

Phthisis Report.—The interim report of the Miners' Phthisis Prevention Committee, signed by Professor J. G. Lawn (acting chairman) and the other members of the committee, has just been issued. It contains much instructive information concerning the amount of dust in mine-air, and touches on a few other related matters. Its chief points are as follows: The dust found in a miner's lung is exceedingly small in size, the majority of the particles being only 0'001 millimetre, or less, in diameter. It is this very fine dust that is responsible for the ravages of the disease.



ARMED POLICE GUARDING THE SHAFT OF THE NEW KLEINFONTEIN MINE.

by the consistency of profit that it has allowed. The issued capital is £604,225, and there is a debt of £124,000 in 5% debentures, now redeemable at the rate of £15,000 per annum. The district is far enough removed from the Rand to render the machinations of labour agitators inoperative, and in 1914 the railway will be sufficiently near at hand greatly to facilitate the delivery of supplies. For the three months ending in June the working profit amounted to £75,440, a result that points to the continuance of the present excellent state of affairs. The life of the property is a factor to which it is almost impossible to assign a precise figure, but it should certainly

Measurements made to determine the amount of mineral dust in mine-air showed that with dry drilling in a drift with walls dry, the dust in suspension was 59 milligrammes per cubic foot of air. With wet drilling and walls wet it was 13; and another series of tests with wet drilling gave averages from 8 to 4 milligrammes. The Committee is quite satisfied that dust-catchers are of little value in drilling, and that the only way to keep the atmosphere reasonably clear of floating dust is to prevent its formation by the abundant use of water delivered into the holes while being drilled. In stopes, while drilling was in progress, the average amount of dust was from 4

to 6 milligrammes. Rock shovelled dry threw into the air 18 mg., and when wetted 2 mg. In return air-ways, immediately after blasting, the amount of dust in suspension was 286 mg.; after passing spraying devices the amount fell to 80, and continued falling, but it was ascertained that water-blasts, sprays, and other devices were powerless to eliminate entirely the enormous amount of dust in the air immediately after blasting. It follows that the currents of air in a mine and the sequence of blasting should be so arranged that the men need not remain or travel in a return air-way after blasting has taken place. Near an exhaust-fan, by which the whole air of a mine was drawn upward, measurements were made with the following results: At 2.0 p.m., 3.5 milligrammes; 2.40 p.m., 1.0 mg.; 3.15 p.m., 9.0 mg. (smoke appeared at 3.35 p.m.); 4.40 p.m., 12.5 mg.; 5.45 p.m., 9.0 mg.; 6.40 p.m., 5.5 mg.; 8.45 p.m., 3.0 mg. More recent tests of the up-cast air of mines, at other times than immediately after blasting, shows averages of 1.5 and 1.6 mg. per cu. ft. of air. As a comparison it is worth recording that the floating mineral dust in the streets of Johannesburg, April to May, 1912, ranged from 2 to 16.5 milligrammes. In Paris the total dust (mineral and organic) after eight days of dry weather was 23 mg., and after heavy rain, 6. Thus it will be seen that the amount of dust present generally in the air of a Witwatersrand mine may eventually be reduced so as to compare favourably with the amount in the air of cities and factories. Many types of respirators were tested with disappointing results. The best of them caught 88% where the amount in suspension was 6 milligrammes, but with large amounts, about 50 mg., they all failed to catch the dust, and some passed 100% of it. A microscopic examination of the dust in air after blasting showed that the particles were exceedingly small and sharply angular; 10% was over 0.007 mm. in diameter, and the remainder was mostly of a diameter of 0.003 mm., or less. Microscopic examination of the lungs of silicotic victims showed that dust particles created by blasting were the most numerous, those from hand and machine drilling following closely behind. Dust from dumps and streets was not characteristically present. Samples of expectorated material were examined and it was found that of the surface specimens 2.5%, and of the underground specimens 15%, contained the bacillus of tuberculosis. The Committee promises a more detailed account of its experiments and investigations at a later date. A great deal

has been done and an enormous sum of money expended to drive this scourge from the Rand. The phthisis sanatorium alone cost the mines £52,000, and the annual cost of maintenance is £11,000. In 1912 the Miners' Phthisis Act was passed and the amount of compensation awarded since the Act came into force up to April 30 last, is £655,832, of which the Government contributed £20,000. In addition to this sum, the contributions by the companies to the Insurance Fund, established under the Act for the purpose of compensating claims arising after July 31, 1914, now amount to £73,000. The mines have also spent large sums in installing extensive systems of ventilation and watering; and as a result health conditions underground have vastly improved and steadily continue to improve.

Oil prospects in the Union are receiving investigation at the hands of E. H. Cunningham Craig, a well known expert saturated with the oil lore of many lands, who has been commissioned by the Government to make a four months' inspection of likely districts with the assistance of officers of the Geological Survey who have special knowledge of the areas to be visited. This step is a most commendable one, for even if no important discovery be made the tour will be productive of reliable information such as may serve as a standard by which to measure the credibility or otherwise of the statements of promoters of dubious ventures. Mr. Craig, in the course of an interview, said that he ascribed the formation of mineral oil to vegetal, and not to animal matter. He considered that the finding of oil was not a difficult matter to one able thoroughly to study the conditions, and affirmed that most of the great finds in America had been made by wild-catting, pure and simple, a process requiring a pile of money. He had in Burma passed over 30,000 miles of country, finding traces of oil everywhere, but only a few spots worth tapping. In Trinidad there were about 600 miles where oil might be found, and only 20 miles can be productive. So far, Mr. Craig's expressions of opinion have not been such as would give rise to optimism, but he thinks that there are possibilities in some of the thicker oil shales. An oil field in South Africa would be a great asset to the Union and to the Empire, and it is to be hoped that Mr. Craig will be able to give utterance to more hopeful views before his tour comes to an end.

The Annual Report of the Mines Department for 1912 shows that the total value of the mineral output for the Union in that

year was £52,711,761, as compared with £47,679,294 in 1911. In mines and kindred concerns there were employed 36,951 white workers, 4944 Asiatics, and 291,724 natives or other coloured persons. The total direct revenue collected in respect of the industry was £2,113,456. The accident death-rate on Witwatersrand mines was 3'90 per 1000, as against 4'10 for 1911. The chief reasons for the high accident rate are: Bad health conditions, 'speeding-up' to secure large outputs, and anxiety to reduce working costs. Second-rate types of miners of mixed nationality are now largely employed, phthisis having killed many of the best men and frightened others. Attempts to reduce working costs too far have shown that the beautiful strong hanging-wall of the Rand so often expatiated upon, has had its day; at greater depths and with increased pressure systematic filling, packing, and timbering have become imperative.

The Randfontein Deep is one of the few deep-level companies possessing possibilities as yet untested. It holds 1255 claims to the dip of the most valuable section of the Randfontein Central, and all of these may be assumed to be underlain by the Randfontein banket, and two-thirds by the Horsham and Lindum seams of the Battery series, which outcrop on the claims. The Randfontein deposit consists of two main lodes, both narrow, and three other seams of banket are now being exploited with fairly encouraging results. The Horsham and Lindum lodes are both poor, but they contain patches of ore that can be profitably worked. The lodes in this section of the Rand strike north and south instead of the usual east and west and dip to the east. In the deeper workings of the Randfontein Central the lode dips at an angle of 50°, and in the Randfontein Deep it is calculated to have a dip of 40°. The ground is being opened up by two 7-compartment vertical shafts, known as the north and the south shafts, each 42 ft. by 6 ft. within timbers, situated 3625 ft. apart and 200 ft. east of the western boundary. These shafts, which are expected to strike the Randfontein series at 3300 ft., were commenced in December 1909; the south shaft was stopped at a depth of 1650 ft. in March 1911, and the north shaft at a depth of 2083 ft. in February 1912, at which date, owing to the limited funds remaining, all work on the property was suspended. During 1911 the north shaft was sunk a distance of 971 ft. at a cost of £45. 6s. 10d. per foot, and the south shaft 400 ft. at a cost of £28. 15s. 4d. per foot. The higher cost of sinking the north

shaft was due to the amount of water encountered during the latter part of the year, and the effect of this inflow can be appreciated by comparing the work done in the months of January and December 1911. In January 133 ft. were sunk at a cost of £28. 14s. 9d. per foot and in December 70 ft. were sunk at a cost of £62. 2s. 5d. per foot. At the end of 1911 the inflow in the north shaft amounted to 600,000 gal. per 24 hours. Apart from this, conditions are favourable to sinking. The company has an issued capital of £667,889, and the cash in hand is approximately £45,000, an amount quite sufficient to cover the expenses of nursing. As at least £500,000 will be required to enable the company to reach the milling stage on a scale suitable to the size of its holding, and as there are no indications that the money-markets of Europe are at all disposed at the present time to incline a sympathetic ear to financial solicitations from Johannesburg, it would be wise in making a valuation to defer the commencement of crushing operations for a period of five years or so. The control of the property is in strong hands, however, and its prospects seem to merit more attention than is being accorded to them at the moment.

The Rose Deep did very well in 1912, as the following comparison shows:

	Year ending Dec. 31, 1911	Year ending Dec. 31, 1912
Tons crushed.....	695,100	782,200
Yield per ton.....	27s. 11d.	28s. 10d.
Working cost per ton.....	17s. 11d.	17s. 5d.
Working profit per ton.....	10s. 0d.	11s. 5d.
Declared working profit.....	£349,030	£446,824
Dividend.....	40%	45%
Profitable mining tonnage developed during year.....	729,012	737,346
Value of " " " ".....	6'4 dwt.	6'7 dwt.
Ore reserve in mining tons.....	3,670,160	3,695,100
Value of ore reserve.....	6'0 dwt.	6'1 dwt.

The total profit shows a steady progress since 1906, but it must be noted that profits have not attained the forecast made at the time of the amalgamation with the Glen Deep; this failure to transmute hope into dividends is in conformity with general mining practice. One reassuring feature is that the value of the ore reserve has slightly increased, which goes to prove that the higher yield has not been obtained by methods detrimental to the future of the mine. For the first half of the current year the working profit totalled £220,471, and a dividend of 25% was declared. In view of recent losses occasioned by labour unrest it is scarcely to be expected that the results of the second half of the year will permit of another distribution of 25%, but it seems reasonable to

expect that the total distribution will approximate closely to that of last year. The ore reserves of this mine are substantial and well in advance of milling requirements, the underground and surface works generally are in good condition, and, given a sufficient supply of labour, the prospects of the mine are undoubtedly bright. In February of this year sand-filling was commenced, attention being first paid to the worked-out areas adjoining the shafts, and the filling of old stopes is now steadily proceeding. Stope-haulages have given useful service and there are now 20 of these installations at work. A great deal of foot-walling has been done with hammer-drills, and these handy little machines have demonstrated their powers to the satisfaction of the management.

The Technical Societies have been guilty of nothing technically world-shaking recently; in fact their journals, though well worth filing for reference, make rather dull reading. The Geological Society after a little spring weather over Rand geology, has been devoting itself to quiet studies for winter evenings. The Association of Engineers has done useful work in drawing attention to the braking of hoisting-engines, a subject for which several nasty winding accidents had prepared an interested reading public. The 'Chemallurgical' Society has been talking cyanide, and flirting with that elusive little thing the atom, instead of attending to its mining business. This Society has been largely instrumental in founding the South African Red Cross Society, an up-to-date body which will replace the local somnolent St. John's Ambulance.

SAN FRANCISCO.

Mother Lode operations are attracting more attention in California. There are three significant events that have tended to bring this about. In the first place, and probably most important, is the fact that continued sinking at the deep mines emphasizes the persistence of the ore-shoots. The Kennedy mine in Amador county now has a vertical shaft 3850 ft. deep, and at its bottom the ore-shoot is as big and as profitable as ever. From the surface down this mine has been in workable ore save at about 1800 ft. when a barren zone, roughly 200 ft. thick, was penetrated. There has been some ore always and stoping has been continuous except for this one zone. There are along the lode a number of mines that have yielded handsomely but which for a variety of reasons have been idle for years. The Plymouth was one such property. With

a recorded production of about \$12,000,000 down to 1500 ft. the mine had long stood idle. In the last year Bewick, Moreing & Co., acting for the California Exploration Co., have re-opened this property, and their success in finding ore is the second important factor in the present awakened interest in the district. Ore-shoots have now been opened on the 1500, 1600, and 1850-ft. levels and in such position as to indicate that two separate shoots have been found. On the 1500-ft. level a shoot 110 ft. long, averaging $3\frac{1}{2}$ ft. wide and \$5 per ton, has been opened south of the shaft. On the 1600-ft. level what is presumably the same shoot has been opened for a length of 245 ft. and averages \$7'20 per ton for the full width of the drift. In a cross-cut the ore has been driven through for 16 ft. and has an average value of \$6'50, the face of the cross-cut still being in ore. The full extent of this shoot on the 1600-ft. level has not yet been defined, and, according to the pitch of the shoots in the mines, this orebody has not yet been reached on the 1850-ft. level. The second ore-shoot was found north of the shaft on the 1600-ft. level and showed a value of \$6 per ton over 115 ft. along the drift. On the 1800-ft. level this ore-shoot is opposite the shaft, and drifts have been driven on it both north and south for a total distance of 300 ft., of which 275 ft. shows an average value, over the width of the drift, of \$6'25 per ton. Here again the full width of the orebody is still to be determined. Additional work is now being done so that definite estimates of reserves can be made. The finding of these two ore-shoots at such depth has amply confirmed the judgment of the engineers responsible for opening the property. The third factor entering is the demonstration that modern methods of cyanidation are applicable to such ores as occur along the Lode. The success of the North Star and Empire mills, treating ore of the same character as found here, and the economy flowing from introduction of cyanidation at Treadwell, have had their influence. At the Black Oak mine at Soulsbyville a modern all-sliming plant, described in the *Mining and Scientific Press* of November 30, 1912, has demonstrated that a 95 to 97% extraction is possible at reasonable expense. Unsettled and unsatisfactory conditions in other industries react to favour gold mining, and there is much evidence that in the Mother Lode district there are good opportunities. In a recent general summary in the *Mining and Scientific Press* J. H. G. Wolf has shown that in 36,675 ft. of the lode between Plymouth and Jackson, there

is 21,950 ft. that is mineralized, and that 14 mines have taken from this ground \$93,800,000. Only four, the Central Eureka, South Eureka, Kennedy, and Argonaut have worked more than 1000 ft. below sea-level.

Oil.—It is announced from New York that the General Petroleum Co. has raised the \$3,000,000 needed for immediate purposes, and that the financing of this rapidly growing concern is progressing satisfactorily. It is also stated that D. C. Jackling is to go on the board, from which it is surmised that Hayden, Stone & Co. are to have a finger in the pie. The projectors of the enterprise are finding that however sound an oil concern may be, its attitude toward capital can only be characterized by quoting from *Oliver Twist*. However the General Petroleum is growing quite as rapidly as its friends could desire. The branch of the pipe-line from Lebec to Mojave was expected to be completed in June. The line is 52 miles long and construction has been rapid. Trenches have been dug for the greater part of the line, and practically all the pipe is on the ground. At Mojave a topping plant of 10,000 bbl. capacity to remove the lighter products from the oil sent through the line, and a 55,000 bbl. and two 57,500 bbl. tanks are nearing completion. The main pipe-line from North Midway to San Pedro—a distance of about 155 miles—is finished, and oil is now stored at Wilmington preparatory to being loaded on the company's tank steamers. About 10,000 bbl. is sent through the line each day, all of which is treated at the topping plant at Vernon to remove the lighter products.

NEW YORK.

Dull Times.—August is normally a dull month in New York; this year it is even duller than usual from a business standpoint, since neither the tariff nor currency legislation has yet been disposed of, while the Mexican situation continues to contribute to a feeling of uncertainty. As a matter of fact, the outlook is unusually good, for banks have been contracting their loans in preparation for the annual demand for money with which to handle the crops in the early autumn, and in addition Congress is promising independently to provide 'agricultural currency' so that no stringency may result. The possibility of a panic this autumn, therefore, becomes remote in the extreme, and, allowing for the effect of the new tariff, which no one can foresee, business ought to be brisk. The annual crisis over, the provision of cash to move the crops has in it an element of the absurd, much as though

a contractor, knowing that workmen must be paid on Saturday night, should each week neglect to provide himself with the necessary cash and go through the same scene with his employees on each recurring pay-day.

Steel Corporation.—The Federal investigation of the United States Steel Corporation, which started with much vigour last spring, seems to have fizzled out, and over 150,000 employees of the Corporation have signed a petition requesting that the proceedings looking toward a dissolution of the company be dropped. Public interest in the investigation has largely evaporated since the disclosures made by David Lamar indicated that the Stanley investigation was a piece of political buncombe, and that many of the efforts to "bust the trusts" were really attempts to extract large counsel fees from them. At the hearings held during April and May the testimony evoked from J. R. Farrell, C. A. Schwab,



Early Snow.

and other steel magnates was favourable rather than the reverse. The testimony showed that the Corporation controlled only 60% of the total output of steel in the country at the time of its formation, and now controlled less than 50%. Wages of operatives have been increased, while prices of steel products have been decreased in many cases. It was further shown that the corporation annually spends large sums to secure the health and safety of its employees, and altogether the testimony that was expected to reveal the crimes of a wicked monopoly showed rather its excellences. The one field in which the Corporation has a monopoly is the export business, which the U.S. Steel Products Co. practically dominates, its exports having increased from \$31,000,000 in 1904 to \$920,000,000 in 1912. The reason for this growth is indicated in the reduction of the cost of doing business in foreign lands which

the corporation has brought about through its better organization, the cost of selling steel abroad having been 10% of the bill-of-lading value in 1904 and only 1% in 1912. On the whole, it looks as though the best thing to do with the investigation is to let the funeral baked meats set forth the wedding feast.

Colombia as a field for investment is attracting much attention in the States. At Barranquilla a new private bank with a capital of \$400,000 has been organized by Cortissoz, Correa & Cia, who are closely affiliated with De Lima, Cortissoz & Co. of New York. The stockholders are interested in the Barranquilla Street Railway, Barranquilla Water Co., the Antioquia Steamship Transportation Co., a tannery, a new brewery, and control the Banco Comercial of Barranquilla. William Plotts, an old Californian, has purchased several tracts of land near Barranquilla, and has brought in machinery for road construction, planning to begin drilling for oil later. Along the coast of the Caribbean, between Puerto Colombia and Galera Zamba, drill-rigs are about to begin work. This is under the direction of Frank A. Kiser. Among the gold-mining operations the Breitung Mining Corporation gets a good deal of publicity. It has options or otherwise holds some 200,000 acres, chiefly along the Cauca river. The Marquette Magdalena Co., a Breitung subsidiary, controls 180,000 acres, and the Negotiation Co., Breitung Mining Co., and Breitung Bond Co. are all interested. If good technical advice can lead to success, good results should follow, as the exploratory work is under the direction of Robert Cranston, a well-known engineer of Californian experience. However, the best of engineers cannot improve the content of gravel or quartz, and it is frequently found in tropical countries that the ubiquitous native has taken out most of the rich patches on which high hopes have been based.

American Institute.—From August 16 to 21 the American Institute of Mining Engineers held its meeting at Butte, with excursions to Great Falls, Helena, and Anaconda. This was the first western meeting of the Institute since the re-organization which it underwent last year, and it gave conclusive evidence of the value of the methods now in force. The meeting was largely arranged by the committee on precious and base metals, of which C. W. Goodale is chairman, and was especially notable for the papers on Montana geology, metallurgy, and mining that it evoked. The Anaconda Copper Mining Co. and its officials could not have been more generous in

the giving of information concerning its technical operations if the meeting had been under its direct patronage, and the papers presented by members of the staff of that company practically form a treatise dealing with all phases of its activity. Six technical sessions were held, and five half-days were devoted to excursions to mines and metallurgical plants. There were in attendance 150 representative engineers, and the excellent papers were followed by animated discussions. The entertainment of the visiting members was lavish, but was properly subordinated to the technical features.

MEXICO.

Political.—The action of the Mexican Government in appointing military governors to the several States, is, in my opinion, making itself generally felt. From all accounts, the Federal troops continue to meet with success, and there seems to be little doubt that the bandits and revolutionists are becoming weaker and numerically less. In fact, so far as the internal condition of things goes, the position is generally becoming more favourable, and the determination of the Government to re-open the most important railroad connections has helped this feeling. The question of greatest moment is, however, bound up in the attitude of the United States. The outcome is full of uncertainty. We are hoping that when an agreement is arrived at between Mexico and the United States it will be one that will constitute a platform upon which a solid and lasting peace can be gradually constructed. General Huerta will probably withdraw, and there will be a general election, and the new Government will have the moral and active support of the United States in quelling such disturbances as may be forthcoming. If such an arrangement as this can be made, Mexico is on the way to an era of great prosperity.

Financial.—A big drop in the price of Mexican bank shares and the violent fluctuations in foreign exchange have naturally had a depressing effect on business. The only thing that can make an appreciable difference in these matters is a settlement of the political disturbance. The Descubridora Company of El Oro has exchanged the nominal value of its shares from 10 pesos to 100. The reason of this is that in such a confined market as Mexico it was found more suitable to have the unit value high and the number of shares low. This point is worth remembering by those intending to operate in Mexico.

Mines.—I am told that the Santa Gertrudis

is doing a great deal better, and that the profit for August will show a big increase, and this must have its effect on Camp Bird and Santa Gertrudis shares. The La Blanca continues to do well, the profit for July being stated at over £17,000. For the year ending June 30, this company made a net profit of \$1,468,885 pesos from 135,942 tons, which gives an average of about 55s. per ton. These satisfactory results from the La Blanca add interest to the operations of the Denny Bros. on the Ohio-Trinidad property. Their shaft is down now about 85 ft. Steady sinking will not be possible until the hoist and other ac-

is doing well, and there is every probability of a resumption of dividends at the end of September.

CAMBORNE

Dolcoath.—A net profit of £25,237 for the six months ending June 30, as compared with £41,136 for the previous half-year, must have proved disappointing to many who had expected better figures, but a jump of 2s. per ton in the cost, due chiefly to the higher price of materials, and a slightly increased ratio of development, coupled with a drop in the average produce of nearly 2 lb. black tin per ton,



THE NEW SANTA GERTRUDIS MILL.

companying equipment have been installed, but it is anticipated that in September this work will be finished, and from that time forward the shaft should make a footage of from 60 to 75 per month. The first cross-cutting will probably be done at a depth of 450 feet.

The Esperanza profit for the last month is a little less than for the previous month, in spite of the published accounts of the rich ore that is being developed on the San Carlos vein. There is certainly a want of clearness in the statements that have been made by this company as to the precise condition of these developments on the San Carlos, and a detailed statement would be appreciated. The shares in the Santa Ana have improved in price from 163 to 173 pesos, as the company

and a 58s. fall in the average price realized, accounts for this. In spite of these facts, the shareholders' meeting was the most cheerful held for some time by reason of the discovery of good ore in the South Entral series of lodes intersected in the cross-cut north from the New Sump shaft at the 210-fm. level; also because of the substantial improvement in the western end of the 550-fm. level, the deepest part of the mine. For years past many mining men competent to judge have advocated lateral development at Dolcoath, and it is gratifying to everyone concerned that the first serious development off the main lode system has been so satisfactory. The South Entral lode was worked by the old people fairly extensively for copper, but no records are avail-

able. So far at the 210-fm. level the lode has been followed for some fathoms and averaged between 35 and 40 lb. black tin. There is a great length on this lode available for development, and already further cross-cuts have been started at the 190 and 230-fm. levels. These should reach the lode in about six months time, while the cross-cut north at the 210 will be extended farther to intersect the East Pool series of lodes. The improvement in the bottom of the mine is very important and the work here will be watched with considerable interest. The manager reported at the meeting that the lode for the last six feet of driving had been worth over one hundred-weight per ton, but as I said in my last letter, it is obviously too early to enthuse, although the prospects are most encouraging. The proposal is now to sink 50 fathoms below the present bottom of the mine.

Carn Brea & Tincroft.—Elsewhere in this issue will be found particulars of the report and accounts for the six months ending June 30, but there are one or two matters on which I should like to comment. In the report it is stated that to lessen the loss, the directors were requesting the manager to reduce development in directions not likely to show "early beneficial results," but I am glad to see that Mr. King, in his speech to the shareholders, stated that he had advised the board "that no such scheme was feasible, the prime necessary is more development." This is unquestionably the right policy; indeed many shareholders would prefer to see the capital now being spent on new crushing plant put into mine development. With a product of such variable monetary value as black tin, it does seem a questionable policy to spend a large sum of money on crushing and dressing plant when an average recovery of only 19 lb. per ton can be shown, which is admittedly all that can, on the average, be expected also from the existing reserves. One would think that the pressing necessity was to find ore of a higher grade, and this can only be done by spending money freely on development, for unless the grade is raised, the most modern surface plant will not reduce costs sufficiently to show a margin of profit sufficient to pay a fair interest on the existing capital and loan. And what if the price of tin had a substantial drop? Indeed the average of the current six months is appreciably lower than the average realized for the previous half-year, which was close on £124 per ton of black tin, or the second highest average in the company's history. Mr. King's speech to the shareholders

was notable for his frank admission that for the first 18 months of his management, the grade maintained was too high, while the reserves have proved not to contain the estimated content. One cannot but admire the manager who has the courage to admit a mistake.

Income Tax and Wasting Assets.—I referred recently to the case of the *Crown v. Basset Mines*, which was successfully brought by the Inland Revenue authorities against the ruling given by the local commissioners that the cost of sinking Marriott's shaft was a revenue and not a capital expenditure. On the discussion of the Revenue Bill in the House of Commons recently, a new clause was moved providing for deductions in respect of inherently wasting assets outside the United Kingdom, but the amendment was negatived because the Chancellor of the Exchequer said it was "impossible to draw an intelligible distinction between wasting and non-wasting assets." Although Cornish mines were excluded from the suggested concession, the question is one with which they should be concerned, and it is up to them to show the Treasury officials how an intelligible distinction can be shown. The task should not be difficult, but who will undertake it?

Grenville United.—This mine reports a profit of £14,446 for the six months ending June 30, which is £4216 less than was made for the previous half-year, although, as no depreciation is charged this time, against £1000 for the six months ending December 31 last, the difference is really greater. It is a curious feature that depreciation is only charged yearly although the accounts are prepared for periods of six months; in any case, such a small sum is by no means adequate for a mine with such extensive, and mostly well-worn, machinery. The sale of black tin was 349 tons, but a reduction of one ton in the stock on hand makes the actual output 348 tons. On the tonnage milled, 22,227 tons, the recovery equals 35 lb. The manager again makes the mistake of giving the recovery as the "average value" of the ore. This "average value" he figures at 36.87 lb. per ton, but even assuming that he means average recovery, the figure is wrong because it appears to have been arrived at by adding together the actual sales and stock on hand, whereas the stock should have been eliminated seeing that a larger stock by one ton was brought forward from the previous half-year. On the information supplied, it is obvious that the real recovery was 35 lb. black tin per ton. The monetary value of the ore

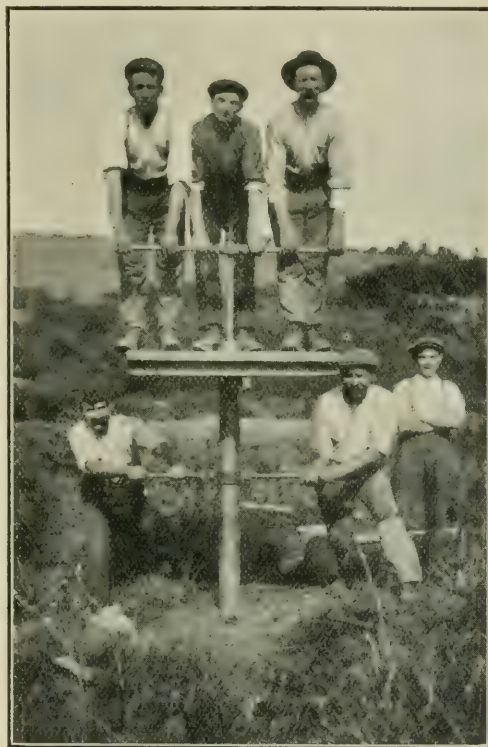
per ton was 44s. 10d., and sundries bring the total receipts to 45s. 5d., while the working cost was 32s. 5d. per ton, which includes 2s. 2d. per ton for royalties. The royalties on this mine are based on profits; when there are no profits, no dues are payable. At the time this arrangement was made by the late Peter Watson, it was hailed with delight by some of the shareholders, but so far it can hardly be said to have been to their advantage. At Dolcoath, where the profit per ton is not far short of that of Grenville, the royalty works out at 2s. 5d. per ton milled, while at South Crofty, the figure is 1s. 2'8d., so that it will be seen that, per ton, Grenville is paying heavily for this unusual royalty basis.

It is gratifying to see that the bottom of the mine is opening up so well. The 375-fathom level (the deepest point) west of Fortescue's shaft, has averaged 40 lb. black tin per ton, and even richer ore has been found in the rise from this point, while in the same level east of the shaft, high-grade stuff has been exposed. In this case, the lode is being mined for a width of 6 ft. and carries a branch 18 inches wide assaying 110 lb. black tin. In both cases, the contents are higher than in the 355-fm. level. It is hoped soon to resume sinking Goold's shaft; the intention is to continue the 335 and 355 levels west from Fortescue's shaft to Goold's and then to rise to meet the shaft, which is certainly the most expeditious way of opening-up this section of the mine. The development footage for the half-year shows a decrease, being one foot to every 18 tons milled, as against one to 13 for the previous six months. This reduction is stated to be due to the increased hardness of the rock, but when the new compressor is at work, no doubt the old ratio will be maintained. The dividends declared show a return of 30% per annum.

Clayworkers' Strike.—Since my last letter, little progress has been made toward a settlement of this dispute. The Workers' Union, finding that the masters continued to stand firm, decided to withdraw the engineers, who had been permitted to work so that the pits might be kept free from water and in readiness for an immediate resumption of work directly the strike had been settled. This serious move, however, had no effect but to further strain the relations between employers and employees. At this stage, but without any invitation from either side, Sir George Askwith (of the Board of Trade), who has of late years successfully settled so many

industrial disputes, visited the district, but without effect, as the masters are determined not to recognize the Union, although this attitude seems somewhat illogical, seeing that they themselves have combined to form a Federation of Employers, and all communications from them, relative to the strike, are issued by that body. Large forces of police have now been imported into the district to protect those men who desire to work.

Helston Moor.—During the summer, C. H. Wray has been conducting boring operations on the flats bordering the Cober river



Drilling at Helston Moor.

above Helston on behalf of the Geri Tin Syndicate. The material tested consists of sand and slime residues accumulated in earlier days. The accompanying photograph shows the drill employed. It is of the Banca type, and was designed by G. W. H. Dew, of London. It is cheap, light, strong, and simple, and any labourer of ordinary intelligence can learn to handle it in a day. Mr. Wray has proved 80,000 tons of material calculated to yield 8 lb. tin oxide per ton, and he estimates another 40,000 tons as probable. The total working cost is expected to be 5s. per ton.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

August 1913	July 1913	August 1912
£69. 6s. 0d.	£64. 5s. 10d.	£78. 17s. 1d.

The improvement in prices which set in last month was carried further in August. The Lake strike is the key of the situation and the trouble there has persisted throughout the month. Accurate information is lacking, but it is understood that the men are now slowly returning. The want of raw material for the refineries is being supplied in part by shipments to America of rough copper from European warehouse. This in turn will leave its mark on the available stocks. Sentiment has been assisted by the more peaceable outlook in the Balkans. The rise in price is notable and from all appearances is likely to continue until a much higher level is reached. The restraint imposed by outside unfavourable influence being at last removed, the market is bounding forward with accumulated force. As the price even now is not unduly inflated, the demand shows no signs of falling off. We look forward to much animation in dealings. The public up to the present has studiously avoided speculative interest in the metal, but the strong position it occupies and the rise in price have drawn much attention, especially from the financial press. It is too much to hope that the public can be kept from taking a hand. Trade activity is undiminished, notwithstanding pessimistic utterances to the contrary, and a fresh impetus in this country at least is given by the recent orders for new ships. The present upward movement looks like lasting over the rest of the year.

TIN.

Average prices of cash standard tin :

August 1913	July 1913	August 1912
£188. 19s. 0d.	£183. 16s. 11d.	£208. 3s. 0d.

The influence in leading interests has been mainly exercised in discouraging any upward tendency in prices while they accumulated stocks by purchasing in the Straits. The trend of prices has nevertheless been upward and from £177, the lowest touched in July, an advance was made to £197 at the end of August. Each advance has been marked with a slight reaction, but the bull party is in good control. The Metal Exchange has again seen some exciting sessions with a large turn-over. The rise has brought consumers

more freely into the market ; large tin-plate orders have been placed and makers have covered their requirements against them. The prospects are for higher prices again, and we shall probably see once more the strongly manipulated markets that have made tin dealings notorious in the past year or two.

LEAD.

Average prices of soft foreign lead :

August 1913	July 1913	August 1912
£19. 15s. 8d.	£19. 7s. 10d.	£19. 5s. 8d.

In this metal prices have been steady at the high levels recently established. Supplies have reached London in good volume but the bear speculation in June and July (which left dealers short for August) has been responsible for keeping prices from declining. The situation still has elements of strength, and it would be premature to hope for a more reasonable level of prices yet. American refiners who are dependant on Mexican bullion have been obliged to give notice of inability to meet September contracts. There is also some fear of an extension of the strike fever in Spain. A strike broke out among the Missouri miners, but is now settled. We still hear complaints from consumers that the high prices are killing business.

SPELTER.

Average prices of good ordinary brands :

August 1913	July 1913	August 1912
£20. 14s. 0d.	£20. 11s. 2d.	£26. 1s. 2d.

A bull account has been built up on the London market but the rise in prices has been freely met by producers. Dealings have been marked with unusual activity and quotations put upon a higher basis. It is doubtful however if consumers' business is more active.

OTHER METALS AND MINERALS.

Prices quoted on September 10 :

SILVER.—27½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £87 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£28 to £30 per ton.

QUICKSILVER.—£7. 5s. per flask.

MANGANESE ORE.—9½d. to 11½d. per unit.

IRON ORE.—Cumberland hematite 23s. per ton at mine. Spanish 20s. delivered.

PIG IRON.—Cleveland 55s. 6d. per ton. Hematite 67s. 6d. per ton.

WOLFRAM ORE.—33s. per unit (1%).

PERSONAL

WILLIAM BACH has gone to the Atchinsk district, Siberia.

HANS C. BEHR, having resigned as consulting mechanical engineer to the Consolidated Gold Fields, has opened an office at 233 Broadway, New York.

J. A. BEVAN has returned to London from the Bodaibo, in Siberia.

F. L. BOSQUI sailed by the *Edinburgh Castle* on August 30 on his return to Johannesburg.

FRANCIS P. BRAY is on his way to London from Melbourne, and expects to arrive here early in October.

HENRY BRELICH is home from Siam.

C. C. BROADWATER was in London from San Francisco.

CHARLES BUTTERS sails for New York by the *Olympic* on September 24.

GELASIO CAETANI is in Colorado.

W. J. CHALMERS, of Chicago, is in London.

C. R. CORNING is directing the operations of the Huanchaca mine, in Bolivia.

P. S. COULDREY, mine superintendent at Cerro de Pasco, is taking a holiday in France.

J. H. CURLE, on his return from Iceland, has gone to India.

ARTHUR DICKINSON is home from West Africa.

A. M. FINLAYSON has returned from Burma, after 2½ years' absence.

JOHN M. FOX has opened an office at Tonopah, Nevada.

B. G. C. GARDNER has returned from Northern Nigeria.

J. A. LEO HENDERSON has returned from Canada.

BERTRAM HUNT has returned from West Africa.

J. POWER HUTCHINS, who has been in the Lena region, has returned to St. Petersburg.

R. H. JEFFREY, manager for the Avino Mines, is home from Mexico.

HOWARD JOHNSON is returning to Nigeria as chief mining engineer to the Niger Company.

NEWTON B. KNOX is on his way to Colombia.

R. N. KOTZE, the Government Mining Engineer, is on his way to Johannesburg.

W. J. LORING leaves for California on September 20.

C. H. MACNUTT has been appointed resident manager to the Burma Mines, in the Shan States.

THOMAS MAUGHAN, for many years secretary of the Chamber of Mines of Western Australia, has been appointed to manage the newly-formed Federated Employers' Assurance of Western Australia.

F. P. MENNELL has taken an office at 49, London Wall, E.C.

F. H. MINARD sailed for New York on September 6.

C. ALGERNON MOREING has returned from a visit to Hungary.

BARBOTTE DE MORNAY is on the Olekma river, Siberia.

H. G. NICHOLS, of Bainbridge, Seymour & Co., has returned from America.

E. C. PARGETER left for Northern Nigeria on September 3.

W. PELLEW-HARVEY expects to return to London in November.

C. W. PURINGTON is expected on October 10 from the Bodaibo region, Siberia.

A. RADCLIFFE is on his way to Copiapo, in Chile.

A. BASIL REECE is due from Nigeria.

WILLIAM RICH, having returned from South Africa, is now touring in France.

C. H. RICHARDS, manager of the Nundydroog mine, is returning to India.

GEORGE J. ROCKWELL has returned to Denver from Jalisco, Mexico.

GEORGE SAFFORD is on his way home from Ecuador.

A. C. E. SEALE, manager for the Sekondi & Tarkwa Co., will be returning to West Africa at the end of September.

PAUL SELBY sailed for South Africa on August 16.

J. T. SWINDLEY is at Kinandam, in Sumatra.

A. ERNEST THOMAS, on his return from Portugal, has gone to America.

W. E. THORNE has been investigating the placers of the Juya and Chara rivers, Siberia.

ARTHUR WADE has left for Australia to examine oil prospects, and will visit British New Guinea.

JOSEPH L. WALTON expects to return from West Africa in October.

MORTON WEBBER, on his return to New York from Mexico, has gone to Ontario.

S. S. WEBB-BOWEN has returned from the Naraguta tin mines, Nigeria.

HERBERT C. WOOLMER is here from the Spassky mine.

QUOTATIONS

of leading mining shares on the London Market.
Shares are £1 par value except where otherwise noted.
Quotations are given in shillings.

	Sept. 1 1912	Aug. 1 1913	Sept. 1 1913
GOLD, SILVER, DIAMONDS.			
RAND:			
Bantjes.....	26	16	15
Brakpan.....	80	66	57
Central Mining (£12).....	232	180	167
Cinderella.....	23	7	6
City & Suburban (£4).....	47	42	43
Consolidated Gold Fields.....	84	46	46
Consolidated Langlaagte.....	27	25	25
Consolidated Main Reef.....	21	17	16
Crown Mines (10s.).....	147	133	132
Durban Roodepoort.....	22	16	17
D. Roodepoort Deep.....	28	20	18
East Rand.....	61	47	46
Ferreira Deep.....	72	57	57
Geduld.....	27	20	20
Goldenhuis Deep.....	32	30	25
Heriot.....	85	57	60
Jupiter.....	12	6	5
Kleinfontein.....	27	18	18
Knight Central.....	15	8	7
Knight's Deep.....	45	40	35
Langlaagte Estate.....	28	22	22
Main Reef West.....	22	10	8
Meyer & Charlton.....	97	102	97
Modderfontein B.....	75	77	77
Modderfontein, New (£4).....	254	237	220
Nourse.....	39	30	31
Primrose.....	38	33	30
Rand Mines (5s.).....	143	126	120
Randfontein Central.....	26	27	24
Robinson (£5).....	82	60	52
Robinson Deep.....	52	33	32
Rose Deep.....	67	57	50
Simmer & Jack.....	22	12	12
Simmer Deep.....	4	2	2
Spring.....	17	16	15
Van Ryn.....	77	66	68
Van Ryn Deep.....	20	30	29
Village Deep.....	46	38	38
Village Main Reef.....	50	40	36
Witwatersrand (Knight's).....	20	67	64
Witwatersrand Deep.....	60	53	53
Wolbater.....	52	14	13
RHODESIA:			
Cam & Motor.....	43	27	30
Chartered.....	31	18	21
Eldorado.....	37	13	16
Enterprise.....	30	9	11
Falcon.....	32	15	19
Giant.....	59	10	12
Globe & Phoenix (5s.).....	36	27	25
Lonely Reef.....	96	49	56
Shamva.....	71	38	42
Wanderer (5s.).....	3	2	1
OTHERS IN SOUTH AFRICA:			
De Beers (£2 10s.).....	441	413	415
Glynn's Lydenburg.....	30	15	17
Jagersfontein.....	132	130	128
Premier Diamond (2s. 6d.).....	238	231	250
Transvaal Gold.....	50	52	51
WEST AFRICA:			
Aboutrickson (10s.).....	7	6	6
Almasa.....	11	15	15
Aman (4s.).....	19	19	18
Broomassie (10s.).....	7	6	7
Prestea Block A.....	18	14	13
Tapiah.....	17	15	15
WEST AUSTRALIA:			
Associated Gold Mines.....	7	7	7
Associated Northern Blocks.....	5	17	11
Edgemoor.....	9	15	16
Edgemoor & Sons (10s.).....	12	5	57
Edgemoor & Sons (10s.).....	10	1	13
Edgemoor & Sons (10s.).....	2	2	2
Edgemoor & Sons (10s.).....	11	8	8
Edgemoor & Sons (10s.).....	77	57	61
Edgemoor & Sons (10s.).....	47	38	38
Edgemoor & Sons (10s.).....	22	20	22
Edgemoor & Sons (10s.).....	10	8	9

OTHERS IN AUSTRALASIA

	Sept. 1 1912	Aug. 1 1913	Sept. 1 1913
Mount Boppy.....	32	15	15
Mount Morgan.....	65	70	71
Tah-man.....	43	40	42
Tasmania Gold (10s.).....	2	1	1
Waihi.....	33	45	45
Waihi Grand Junction.....	22	22	21

AMERICA:

Alaska Treadwell (£5).....	175	160	162
Buena Tierra.....	18	17	17
Butters Salvador.....	35	40	40
Camp Bird.....	29	15	17
El Oro.....	13	14	14
Esperanza.....	36	21	21
Granville.....	15	11	11
Mexico Mines of El Oro.....	147	105	112
Oroville Dredging.....	5	5	7
St. John del Rey.....	17	16	16
Santa Gertrudis.....	31	16	20
Stratton's Independence (2s. 6d.).....	2	2	2
Tomboy.....	26	26	26

RUSSIA:

Lena Goldfields.....	80	52	55
Orsk Priority.....	21	15	10
Siberian Proprietary.....	16	3	2

INDIA:

Champion Reef (2s. 6d.).....	13	10	12
Mysore (10s.).....	115	102	105
Nundydroog (10s.).....	33	25	25
Ooregum (10s.).....	17	19	21

COPPER:

Anaconda (£5).....	186	146	157
Arizona (5s.).....	43	38	40
Cape Copper (£2).....	166	110	125
Chillagoe (10s.).....	4	1	1
Great Cobar (£5).....	107	48	43
Great Fitzroy (5s.).....	2	1	1
Hampden Cloncurry.....	49	42	43
Kyshtim.....	67	58	63
Messina (5s.).....	22	27	30
Mount Elliott (£5).....	167	100	116
Mount Lyell.....	30	24	25
Rio Tinto (£5).....	1640	1497	1585
South American Copper (2s.).....	31	34	34
Spassky.....	95	66	71
Tanganyika.....	60	46	49
Tharsis (£2).....	135	140	147
Whim Well.....	27	13	16

LEAD-ZINC:

BROKEN HILL:

Amalgamated Zinc.....	34	31	33
British Broken Hill.....	51	39	38
Broken Hill Proprietary (8s.).....	51	35	36
Broken Hill Block 10 (£10).....	47	28	27
Broken Hill Block 14 (25s.).....	10	6	6
Broken Hill North.....	136*	48	51
Broken Hill South.....	163	152	152
Sulphide Corporation (15s.).....	26	25	27
Zinc Corporation (10s.).....	13	17	18

TIN:

NIGERIA:

Abu (5s.).....	—	14	12
Bisichi.....	24	20	21
Jos (5s.).....	7	7	8
Kaduna (5s.).....	27	20	20
Naraguta.....	30	34	38
Nigerian Tin.....	36	23	27
N. Nigeria Bauchi.....	8	4	5
Ravhold.....	26	20	23
Ropp.....	56	137	152

OTHER COUNTRIES:

Aramayo Francke.....	29	32	32
Bismarck.....	9	8	8
Cornwall Tailings.....	37	22	25
Dalhousie.....	26	17	22
Geevor (10s.).....	15	16	21
Gopeng.....	77*	31	31
Mawchi.....	28	18	20
Rosenberg.....	31	32	38
Tekka.....	67	60	62
Tronoh.....	73	57	61

* Capital re-arranged during year.

TIN MINING IN MEXICO

A neglected industry. Geographic distribution and geologic occurrence of tin deposits.
Prospects for profitable enterprise.

By GEORGE CHESTER MASTER

THE mineral cassiterite is widely distributed in Mexico and has been worked by the natives in a desultory manner for a period ante-dating the conquest of the country by the Spaniards in 1521. Tin deposits have been worked in the following states: Durango, Jalisco, Guanajuato, and San Luis Potosi ;

serious work will be done and the districts properly prospected and exploited.

In the following notes I propose to describe, in a general way, the occurrence of tin and the present methods of mining and smelting as performed by the natives in the neighbourhood of San Luis Potosi. The districts that



A BIT OF THE STUFF.

some of these have been described by Edward Halse in a paper entitled 'The Occurrence of Tin Ore at Sain Alto, Zacatecas, etc.,' 1899; also by Walter Renton Ingalls in 'The Tin Deposits of Durango, Mexico,' 1895. These papers were read before the American Institute of Mining Engineers. Except for a few isolated cases, foreigners have not interested themselves in the occurrence of tin in Mexico, and it is only within the last year or two that properties have been acquired by them. It is to be hoped that now some more

I visited, and in which I have worked, are in the two states named last; in some cases the country was very rough, rugged, and devoid of vegetation except for a few cacti, whereas in other parts they were easy to traverse and in places covered with medium-sized oak and pine trees, with good waggon-roads, and often quite near a railroad. In most cases water is scarce and could only be obtained in sufficient quantities for dressing purposes by building dams or sinking artesian wells. There are a number of these wells in the San Luis Potosi

district, on the ranches where some of the old mines are being worked; these give an ample supply of water for irrigation purposes.

The elevation above sea-level of the tin districts may be said to vary from 5000 to 9000 ft. The rocks are of igneous origin and porphyritic structure, the surrounding country being covered by large overflows of lava, evidently forced through the underlying beds of shale and limestone, which can be seen outcropping here and there. These probably belong to the Cretaceous age. This acid lava in most cases was either rhyolite or rhyolitic tuff and of a stony nature, quite distinct from the more vitreous rhyolites so common in Mexico; with the naked eye the rounded porphyritic crystals of quartz and large rectangular crystals of felspar can easily be distinguished; in some localities the flow structure is pronounced, giving a banded appearance to the rock, adequately described by Mr. Ingalls in the afore-mentioned paper; he says "the ordinary rhyolite-tuff of the region shows a most striking fluidal texture, which is so marked in certain places that the exposed outcrops have the appearance of stratification." In places it has been altered almost beyond recognition, at least with the naked eye; the crystalline structure has entirely disappeared, and it can easily be broken with the fingers. This is evidently due to percolating solutions, which have impregnated the fractures and fissures with oxides of tin, iron, and manganese, altered the country-rock, and partly replaced it with the metallic oxides mentioned. There are numerous dikes of other porphyritic rocks, but so far I have not noticed that these bear any relation to the occurrence of the cassiterite.

The orebodies are found in mineralized belts; these are several hundred yards wide and I have traced them for over six miles. The mineral is found in fissures and fault-planes within these belts, usually running parallel to one another, due northwest being the usual strike. These veins vary in thickness from the fraction of an inch to 10 ft., and the ore-shoots are of various dimensions, the largest that I have already seen being 1 to 8 ft. thick, 6 to 30 ft. long, and 100 ft. deep. At one old mine there were two parallel deposits carrying cassiterite about 50 ft. apart; these were connected by stringers running in all directions and at all angles from one to the other, and from the evidence of old workings they had been worth following, and made the deposit like a stockwork. In some cases well defined walls limit the ore, while in others it gradually passes into the much altered coun-

try-rock, which is impregnated with tin oxide for a considerable distance from the original deposit or vein; but this is characteristic of tin deposits. Despite the usual irregular walls the deposits are persistent along their line of strike, and in many places old workings can be traced for several hundred yards on the same vein. It is probable that before the appearance of the tin there was some sort of fissure in the rhyolite, and the solutions carrying that metal rose through this fissure penetrating every fault-plane and adjacent crevice, altering the country-rock in the vicinity and wherever the conditions were favourable, leaving behind a deposit of tin oxide and associated minerals.

Cassiterite occurs in crystalline bands, and, where the walls of the deposit are regular, is often on either wall with a matrix between composed of broken pieces of country-rock cemented together with nodules and small stringers of cassiterite; these are sometimes intermixed with chalcedony and more rarely with lime. Such bands vary in thickness from a fraction of an inch to several inches of solid crystalline cassiterite. Nodules of the same mineral occur in reniform masses, and I have seen these up to 25 lb. weight of nearly pure tin oxide. The crystalline variety is usually of a reddish-brown colour, but the nodules vary from jet black, brown, red, pink, or yellow to nearly white, frequently showing a beautiful radiating structure which resembles the grain of wood. Sometimes these nodules have for a nucleus a piece of country-rock or quartz, and around this cassiterite has been deposited in intermediate layers with quartz or lime. In a few cases I have seen specimens resembling a stalactite, the centre part being composed of tin oxide and the outer layers of lime. Oxides of iron and manganese are common in these deposits, and in places the cassiterite entirely gives way to the oxides of the former metal.

Up to the present date no systematic mining or prospecting has been done, and only in a few cases have the natives procured titles to the properties. They operate in the following manner: There is a small roving population of tin miners; sometimes ten or more of these get together and go to the owner of a ranch on whose land tin is known to exist, and arrange to pay him a small royalty on any tin extracted, besides a small rent for the right to build their huts, use of firewood, and make the necessary charcoal for smelting their ore; often the ranch-owner finances the miners to enable them to make a start, and after he has



THE USE OF THE 'PLANILLA' AND 'BATEA'.



NATIVE FURNACE.

once lent them money they are more or less in his power. This practice is of course illegal, because the tin does not belong to the owner of the surface land but to the Mexican Government, and in this manner the Government is deprived of the annual taxes for the mining claim, also the royalty on the metal extracted. According to the mining laws of Mexico the owner of the surface land is entitled to any combustible substances discovered thereon, such as coal or oil, salts or building stones, all metalliferous minerals belonging to the Government. When a promising outcrop or vein has been 'located,' work is started at once and this is often profitable from the commencement. In most cases the first few feet of excavation can be accomplished without the use of explosives, pointed bars and wedges being used; in fact, the actual vein-stuff is always mined with such tools, powder only being employed in sparing quantities to loosen the surrounding country-rock where it is exceptionally hard. The workings themselves are usually very irregular, having followed the shoots only where it payed to work them, but in one or two cases I have seen veins that can be traced on the surface by old workings for over 500 ft., some of which have fairly regular open stopes, from wall to wall measuring about 3 ft., and in some cases these

workings are more than 100 ft. deep. In places there are good-sized stopes where the ore-shoots have widened out to 6 and 10 feet.

Where ladders are necessary, those known in Mexico as chicken-ladders are used. They consist of nothing more than a mere rounded or untrimmed palm or pine-tree, with little notches cut every 8 or 9 inches, on which one has to place the foot sideways. These appear clumsy at first, but after a little practice one can travel faster on them than on an ordinary ladder, and the cost is much less. Occasionally, in old mines, I have seen these ladders where they have been made of oak or other hard woods, and have become polished and nearly black with age, and no doubt have been in use for over one hundred years. All ore and waste is carried out in sacks on the backs of the miners, and it is a rare occurrence to see them using a windlass, but this is partly explained by the irregularity of the workings and the want of sufficient capital to sink proper shafts.

A wrong impression of these old mines is easy to get, by taking samples from the faces as left by the natives, because, as is only natural, they continued to work while it paid them to do so, but directly the vein narrowed down or the ore-shoot was a bit pinched, they abandoned the workings, not having sufficient capital to do some dead-work and look for the continuation of the ore as, of course, has to be done in some of the best of mines, it being no criterion that because an ore-shoot is pinched in one place that it will always continue so.

There are several districts where these old mines are found, and at the present day some of them are still being worked, while others have been abandoned and filled with waste nearly up to the surface.

The ore, when brought from the mine, is 'cobbed' to about $\frac{1}{4}$ inch by hand and sorted, then washed in a 'planilla,' and finally in a wooden 'batea.' A planilla is a hole dug in the ground about 5 ft. long, 3 ft. wide at the upper end, at the lower about 2 ft., with a sloping surface of from two to five degrees toward the narrow end, where there is a cup-shaped hole in which the water collects; the depth excavated below the surface is only a few inches and stones are placed at the sides to prevent the water or concentrate from being washed away and lost. The process of concentration consists in placing from 60 to 120 lb. of ore at the upper end of the planilla and filling the hole at the lower end with water; the latter is then thrown on the ore by means of a horn cup, and as one would expect,

the waste and material of a lower specific gravity tends to be washed down the slope, the cassiterite remaining at the upper end. This process is repeated at least twice on the same ore; the concentrate then receives a final washing in a wooden batea. If local conditions permit it, the planilla is always made at the side of a running stream, so that the water can be run direct into the hole; but this is usually an exception to the rule, for in most cases, the mountain streams in the vicinity of the mines only contain water for a few months of the year and the miners prefer to carry the water to the ore. The concentrate varies in richness from one mine to another, and is, of course, also improved in quality if the ore is cobbed and ground finer, but it averages from 45 to 65% tin. The concentrate is then dried, collected in sacks, and put aside for smelting.

The small blast-furnaces used by the natives are built of any hard stone, cemented together by a clay called *tierra del fuego*, found locally in most of the tin districts. The inside dimensions of the furnace are: height 2 ft. 6 in.; at top the feed opening measures 5 in. square; the front inside is vertical but the back and sides slope outward, and the inside diameter at the bottom is 9 in.; the bottom of the furnace has a steep slope toward the open hearth in front, the latter being merely an excavation with a clay-lined floor. In some cases 'adobes' (mudbricks) are built up on top of the furnace 2 or 3 ft. high to protect the men at the bellows from fumes and sparks. The outside dimensions of the furnaces vary, but a good idea of these can be obtained from the accompanying photograph. The blast is produced from two bellows, worked alternately by two men. These bellows are made of ox-hide, and are well illustrated in Mr. Halse's paper of September 1899. The nozzles of these two bellows unite, forming one tuyere, made of a piece of iron pipe, about 8 in. above the bottom of the furnace; the blast enters the latter through a large hole, quite 3 in. diameter. Much air is lost at this point, but the reason for having the hole so large is that the furnaceman can use it for looking into his furnace and can insert a small iron bar should the charge cake, without it being necessary to stop the blast entirely. When the concentrate is low in tin contents, for instance 45% tin, it is customary to mix it with other concentrates of about 65%, that is, if the latter can be obtained in the district, in the proportion of two of the former to one of the latter. The concentrate obtained from washing the alluvial in the 'arroyos' (river-beds) is always in great

demand for smelting, because it is easier to flux and richer in tin, but its supply is very limited, on account of the precipitous sides of the arroyos and the general topographical features of the country, which are not favourable to the collection of large alluvial deposits, at least in the immediate neighbourhood of the veins. Individual miners sometimes strike rich pot-holes in the river-beds, and these are worked from year to year, because during every rainy season they collect considerable tin oxide; this, when washed and concentrated, will assay 70% tin.

Before commencing operations the furnace and hearth are always re-lined with clay, and when dry, charcoal is fed into the furnace and a light blast admitted until the temperature begins to rise, then moistened concentrate (which has previously been crushed to $\frac{1}{8}$ in.) is fed, in the proportion of one part of concentrate to three parts of charcoal (by weight); when the furnace is thoroughly hot, one part of 'hard-head' is fed to every 8 parts of concentrate. Hard-head is tin and iron alloyed in various proportions, and is obtained from the slag of previous smelting operations. As much as 450 lb. of various concentrates are often smelted at a time, and when the operation is nearing its end, the slag is broken to 1 in. and re-smelted. The second slag is broken afterward to $\frac{1}{8}$ in. and carefully washed, the resulting pellets of tin and hard-head being reserved for a subsequent smelting operation. The treatment of 450 lb. of concentrates takes 16 hours. It is hard to give an exact estimate of the loss of tin in the operation because, as before mentioned, the washed slag and hard-head from previous smeltings are always added, if available, and these vary considerably in their tin contents, so without careful assays I can only say that the loss is approximately 10%.

The cost for smelting 450 lb. of concentrate, including charcoal and labour, is 16'20 pesos (about 32s. 5d.)

The cost is divided as follows :

	Pesos
1350 lb. Charcoal	8'64
One furnace-man at 12 c. per 25 lb. concentrate smelted	2'16
Four men at the bellows at 6 c. per 25 lb. concentrate smelted	4'32
One furnace-feeder at 6 c. per 25 lb. concentrate smelted	1'08
	<hr/>
	16'08

The metal is allowed to run out on to the hearth every few minutes by lifting the solidified slag and clinkers with a long pole tipped

with iron. As one would imagine, this method is wasteful and a large percentage of the tin adheres to the clinkers. When about 25 lb. tin has been run out, it is doubled up and eventually shipped in sacks, each containing 100 lb. There is always a good market for the tin locally; the store-keepers in the nearest towns buy the metal to re-sell at a profit to the large firms in Mexico City. The tin is thus sold without being refined and contains from 90 to 96% metal. I shall conclude these notes by saying that it seems strange to me that a district containing tin, in a country where transport is easy, labour cheap, the climate perfect, and tin prospects bright, remains unexploited, when one thinks of the large sums of money invested in out-of-the-way places, like Northern Nigeria, where the difficulties and expenses for prospecting are treble what they are in Mexico.

Mineral Production in Great Britain.

The first part of the Mines and Quarries Report for the year 1912 contains the following figures for the output of minerals in the United Kingdom for 1911 and 1912 :

	1911 Tons	1912 Tons
Alum Shale.....	10,516	11,258
Arsenic	2,144	2,194
Arsenical Pyrite.....	1,170	2,450
Barium (Compounds)....	44,118	45,377
Bauxite	6,007	5,790
Bog Ore	2,700	3,340
Chalk.....	4,884,020	4,285,412
Chert, Flint, etc.....	71,577	74,718
Clays and Shale.....	13,835,038	12,808,950
Coal	271,891,899	260,416,338
Copper Ore and Copper Precipitate.....	3,262	1,933
Diatomite.....	—	62
Fluor Spar	55,231	47,246
Gold Ore.....	2,752	170
Gravel and Sand.....	2,280,248	2,191,451
Gypsum	276,684	285,291
Igneous Rocks.....	6,524,696	6,638,215
Iron Ore.....	15,519,424	13,790,391
Iron Pyrite.....	10,114	10,522
Lead Ore.....	23,910	25,409
Lignite.....	120	62
Limestone (other than Chalk)	12,183,355	11,500,660
Manganese Ore	4,987	4,170
Mica.....	25,335	29,962
Natural Gas.....c. ft.	221,400	c. ft. 161,200
Ochre, Umber, etc.....	14,585	13,947
Oil Shale.....	3,116,803	3,184,826
Rock Salt.....	200,620	218,055
Salt from Brine.....(a)	1,924,655	1,904,195
Sandstone	4,044,907	3,839,567
Slate and Slate Slabs....	425,125	383,422
Soapstone.....	—	8
Sulphate of Strontia.....	5,869	19,370
Tin Ore (dressed).....	7,746	8,166
Uranium Ore	67	42
Wolfram	266	193
Zinc Ore	17,652	17,704

FEATURES OF SOME RHODESIAN OREBODIES

Characteristic types. Banded Ironstone. The Antelope, Connemara, Golden Kopje, and Wanderer Mines. Banket Deposits. Eldorado and Shamva Mines.

By F. P. MENNELL

INTRODUCTORY.—Judging from the tone of the share-market, it might well be imagined that Rhodesia was a country of small mining possibilities. Looking at the matter, however, from a strictly professional point of view, uninfluenced by market considerations, the situation assumes quite a different aspect. It is no longer possible, in fact, to regard Rhodesia as merely a country of a few small mines. Every year it becomes increasingly evident that it has a fair share of big things, even if we confine ourselves to gold mining alone. The larger lodes are seldom ordinary quartz veins, and are, therefore, specially interesting from a technical standpoint. They are generally mineralized zones or masses of rock rather than veins in the conventional sense, and are perhaps most conveniently termed 'impregnations.' In the Archean areas, or 'schist belts,' as they are popularly termed, almost any kind of rock may contain gold, but so far the metamorphosed sediments known as the 'banded ironstones' and the conglomerate series have come into most prominence. It is some of these deposits that I shall describe.

IN THE BANDED IRONSTONE.—It should be premised, for the sake of the uninitiated, that the deposits termed in Rhodesia 'banded ironstone' are iron-bearing rocks such as are characteristic of almost every Archean area. They are conspicuous features around Lake Superior and in Canada generally, as well as in India, Brazil, tropical Africa, and Western Australia. They may vary from almost pure quartz to nearly pure iron oxide, but they must originally have been coarse to fine mechanical sediments (sandstone and shale), as shown by structural relations and distribution. They are variously known as 'ferruginous chert,'

'banded jasper,' 'magnetic quartzite,' 'hematite schist,' 'calico rock,' 'itacolumite,' 'itabirite,' 'jaspilite,' and no doubt by other names according to locality. They contain the largest number of the Rhodesian gold occurrences that may be regarded as impregnations, a fact that contrasts with the rarity of workable quartz veins traversing the rocks of the Banded

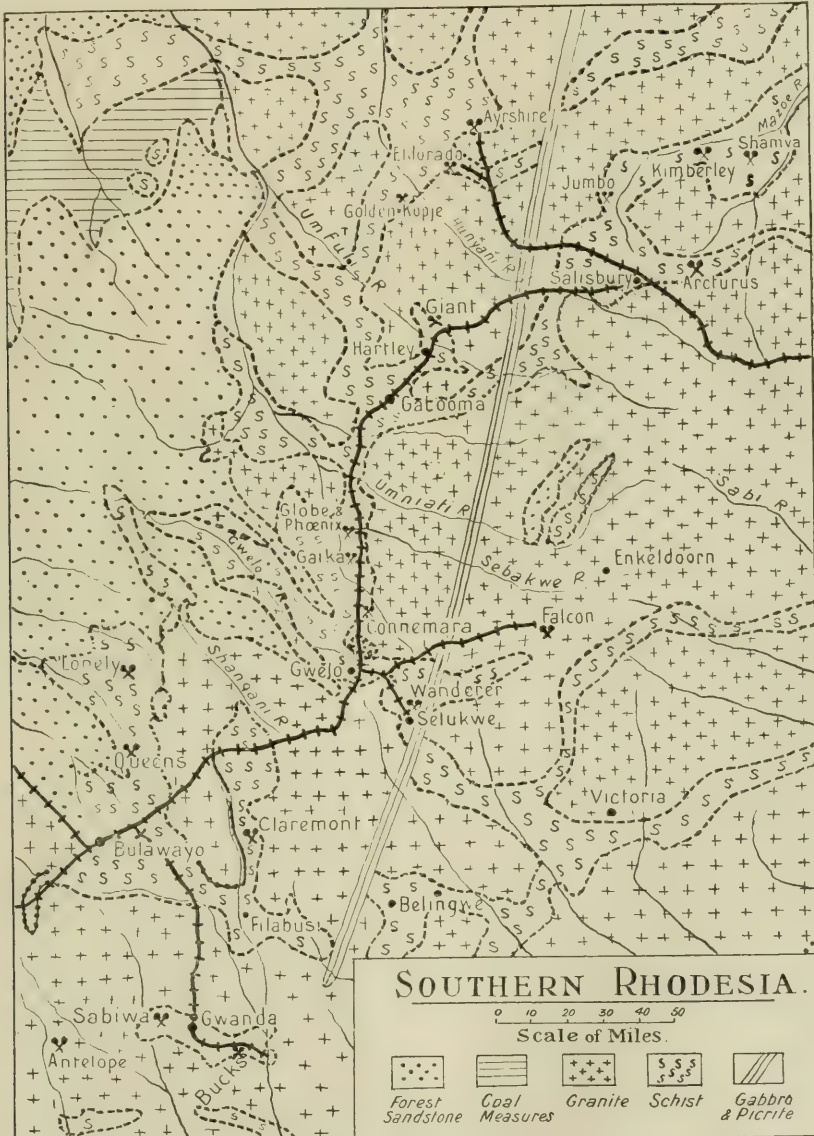


Banded Ironstone in the Bed of the Sabakwi River.

Ironstone series. Thus, whereas I can only enumerate four so-called 'reefs' or veins in Banded Ironstone country, namely, the Bristol, Champion (Gwanda), Susanna, and Veracity, there can be cited the following large impregnations: Antelope, Camperdown, Concession Hill, Connemara, Giant (in part), Golden Kopje and Union Jack, Long John, New Found Out, Sabiwa, Wanderer, and Zambokwe, this list comprising several of the best known mines in Rhodesia. They are, moreover, scattered right over the country, from the north of Mashonaland to the south of Matabeleland.

ANTELOPE MINE.—This is situated on the south side of a narrow belt of schistose rocks, only half a mile wide, if one excludes the marginal modifications of the granite, which has been much altered in composition by absorption of material from the adjacent schist. In

by a thin strip of much altered schistose serpentine, while on the north hornblende and pyroxene granulites are succeeded by more banded ironstone before the granite is encountered. The schist belt is penetrated here and there by dikes given off from the adjacent



spite of its narrowness, the schist belt extends for many miles east and west of the mine, along the southern edge of the great Matopo granite mass, of which some 45 miles is traversed in proceeding to the mine from Bulawayo. The orebody is hard banded ironstone, only separated from the granite on the south

granite masses. These dikes are sometimes of types differing little from normal granite, but are generally of a pegmatitic or aplitic nature. The vicinity of the dikes appears distinctly favourable to the ore being of good grade. The banded ironstone everywhere shows marked contact alteration, the develop-

ment of hornblende needles being usually discernible by the naked eye, while, under the microscope, the rock appears as a granular aggregate of quartz, magnetite, pyrrhotite, and hornblende, often with zoisite, and a little apatite. The banding is somewhat obscure, but still traceable. There is much to suggest that the gold was deposited before the metamorphism of the rock; for example, the freshness of the hornblende and its relations with the pyrrhotite. Signs of secondary enrichment are rare, unless it be the occasional occurrence along cracks of pyrite, which is absent from the normal ore, a feature probably connected with the intrusion of the granitic dikes. The lode dips north at 60°, and the vertical main shaft consequently gives a good section of the overlying granulites. These comprise bands of what may originally have been limestone, now entirely converted into a coarse-grained aggregate of green pyroxene with some calcite and occasional well developed crystals of grossular garnet. The 'ancient' workings on this line of ironstone continue for some three miles, but it is only here and there that sulphide ore of good grade has been found beneath them. On the main ore-shoot the shaft is down over 1000 ft., and the grade at the lowest points reached compares well with that near the surface. On the 6th level, according to the engineer's reports, assays average 12 dwt. over 57 inches for a length of 500 ft., while on No. 7 the average is 10 dwt. over 54 inches for over 600 ft. A reduction plant is in course of erection, and the ore reserves are announced as 130,000 tons averaging just over 10 dwt.

CONNEMARA.—This property is interesting as the most recently discovered of those that have already been sufficiently developed to justify flotation of the claims into a mining company. Another interesting point is that the orebody is in virgin ground, quite untouched by the ubiquitous 'ancients.' That it should so long have eluded the modern prospector is remarkable in view of its situation on a low ridge just beside the old main road between Gwelo and Sebakwe. The outcropping ironstone had nothing different in its appearance from hundreds of other occurrences where no gold is to be found, though it gave some rich assay-results. Pannings, it is true, only revealed about one-third of the total gold present, but even that was an attractive amount in places, as will be evident from the fact that the most prominent part of the outcrop assayed 46 dwt. over a width of 8 feet, while trenches cut at about 50 ft. distance on either

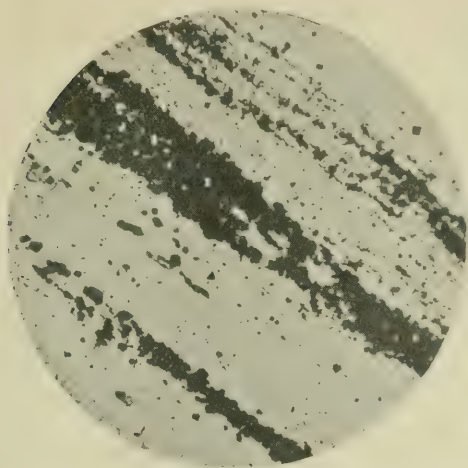
side gave assays of 17 dwt. over 9 ft. and 10 dwt. over 20 ft., respectively. The deposit as a whole is of much lower grade even in the oxidized zone than these figures might appear to indicate, and they afford an instance, distinctly rare among the banded ironstones, of marked surface-enrichment. The ore reserves are given in a recent report as 180,000 tons averaging about 7½ dwt.

GIANT.—This mine, though it has recently fallen upon evil days, owing to what is regarded by the management as a fault cutting off the orebody between the 6th and 7th levels, has been one of the most profitable in Rhodesia. Its geology is in many respects similar to that of the Antelope, the country consisting of banded ironstone associated with much-altered serpentine, close to a granite contact. It differs, however, in the fact that the banded ironstone has been much disturbed and shattered, while the serpentine has been profoundly altered by the effects of circulating water. A sort of composite rock has thus been produced, consisting largely of chlorite and talc schist; and it is this that carries most of the gold. The ore is in places heavily charged with pyrite and pyrrhotite, the last containing traces of nickel and cobalt. Pyroxene granulites occur on the adjacent New Found Out claims, and appear to be due to the metamorphism of the banded ironstone itself. The last constitutes the whole of the orebody on this mine, the ore being arsenical and highly refractory, unlike that of the neighbouring Giant. The aplitic dikes that traverse the schist belt near these properties often contain garnets, as is the case at the Antelope.

GOLDEN KOPJE.—This locality is about 15 miles west of the Eldorado mine in the Lomagundi district. There is a prominent outcrop of the ironstone, overlooking a *vlei* or swampy flat concealing the edge of the granite, which is just south of the mine. To the north the conglomerate series occurs with limestone beyond it. The Golden Kopje itself was formerly known as the Montrose mine, and produced a considerable amount of gold under that name, almost entirely from an open-cut. It was, like the Connemara, virgin ground, untouched by the 'ancients,' but there were old workings on the adjacent Union Jack claims, with which it is now amalgamated. Though so close to the granite, the orebody shows little sign of contact-alteration; indeed, it is perhaps the most normal-looking of any banded ironstone that is auriferous. Under the microscope the rock has the appearance of a close-grained quartzite, with bands alter-

nately rich in iron oxide (magnetite) and nearly free from it. As may generally be noticed, the crystals of magnetite often occur in the middle of quartz grains, thus evidencing the complete re-crystallization of the whole. At a depth the rock becomes more slaty-looking, and is rich in pyrite, as appears usually to be the case where the ironstone is unaltered by surface agencies.

WANDERER.—This mine has at present the largest crushing capacity of any in Rhodesia, treating about 15,000 tons of ore monthly. It also boasts the largest orebody and the lowest working cost in South Africa. It is situated in the Selukwe district, about 7 miles from the township of that name. J.



Microscopic Section of Banded Ironstone from the Golden Kopje.

W. Gregory* has given a detailed description of the deposit, and it is accordingly unnecessary to enlarge upon the subject here. It may be noted, however, that the occurrence of gold seems closely connected with the shearing and shattering to which the rock has been subjected, and that the gold contents are, as a rule, highest where there is most iron oxide in the vein-matter. Another interesting fact is that the rock in depth sometimes passes into what in the Lake Superior region has been termed a 'cherty iron carbonate.' That is to say, the iron oxides decrease, and the rock appears under the microscope as a very fine-grained quartz aggregate with streaks of a carbonate, which is no doubt chalybite, and specks of pyrite. The banding is still well marked in hand-specimens. Associated with the ironstone, and at times forming part of the orebody, are some gneissic-looking rocks,

which it has been suggested are of igneous origin. I do not, however, think that this is the case, as their microscopic characters, in spite of the intense crushing to which they have been subjected, strongly suggest a sedimentary origin. They are best regarded as metamorphosed grits belonging probably to the conglomerate series. There does appear to be a small acid dike at one point, but it is altogether later than the formation of the orebody. I am indeed inclined to consider the



Open-Cut on the Wanderer.

whole deposit as an example of ore deposition without the aid of igneous intrusion.

THE CONGLOMERATE SERIES.—In three different localities the rocks of the conglomerate series are known to carry gold in appreciable amount. These are in the districts of Lomagundi, Sebakwe, and Abercorn. The deposits were discovered in the order named, although the first actual production of gold was recorded from the Riverlea mine, at Sebakwe, where a dry-crushing plant started work early in 1907, before stamps were dropped on the Eldorado.

LOMAGUNDI BANKET.—The beds of conglomerate on which the Eldorado mine is situated run for many miles in an east and

*Trans. I.M.E., 1906, p. 32 of A.C.

west direction from that property. The character of the rock, however, changes considerably as one travels in either direction, and the appended notes are chiefly based on specimens from the Eldorado mine. The exposure in the bed of the Hunyani river, west of the Rowdy Boys claims, is a magnificent one, and gives much the clearest idea of the field relations of the rocks, but for petrological purposes the fresher specimens obtainable underground are naturally to be preferred. The matrix of the rock varies a good deal, but typically it is a finely foliated aggregate of green hornblende, brown biotite, quartz, and felspar, together with epidote and sometimes chlorite, as well as some calcite, magnetite, and pyrite. Large grains of detrital quartz are often seen, and there can be little doubt that the whole was originally of a muddy nature, probably similar to the complex mixture of decomposing silicates derived from the common epidiorites and hornblende schists of the present day. The pebbles are of granite, granophyre, banded ironstone, actinolite schist, quartz, and even crystalline limestone, the first named being the commonest. The banded ironstone pebbles are very interesting as showing obvious signs of contact metamorphism, and indicating, therefore, that the granite, of which so many pebbles occur, was of later date than the Banded Ironstone series. It may be remarked incidentally that no traces of a granite older than the conglomerate now remain; all the great present-day masses are of later intrusive origin. A pebble of crystalline limestone obtained by me from the Eldorado 4th level also demonstrates the existence of a series of limestone older than the thick masses overlying the conglomerates to the north. I had the good fortune, while examining the 3rd level stopes in the Eldorado, to secure a specimen throwing a great deal of light on certain problems connected with the deposition of the gold in the ore. The specimen was chiefly remarkable for a small oval granite pebble, with visible gold not only round it, but in it, and it appeared to be an exception to the general rule that if gold occurs in the pebbles it is always along cracks. On slicing the rock, however, this apparent anomaly was found to be merely due to the way in which the gold was irregularly disseminated along closely set systems of intersecting fractures, not recognizable by the naked eye. Every pore of the rock, so to speak, appears, under the microscope, as if saturated with gold. Microscopic observations of this and other representative specimens lead to two important deductions. First

of all, the gold cannot be considered as alluvial. It was evidently an impregnation after the original consolidation of the rock, or it could not occur distributed as it now is. It was equally clearly deposited before the metamorphism of the conglomerate, for in the matrix it is distributed together with some sulphides through perfectly unaltered biotite and hornblende, completely enclosed within them in some cases. These minerals cannot have existed in their present form in the rock as originally laid down, and it is equally clear that if they had been formed before the gold was introduced, the latter process would have involved an amount of alteration quite incompatible with the present absolutely fresh state of the rock.

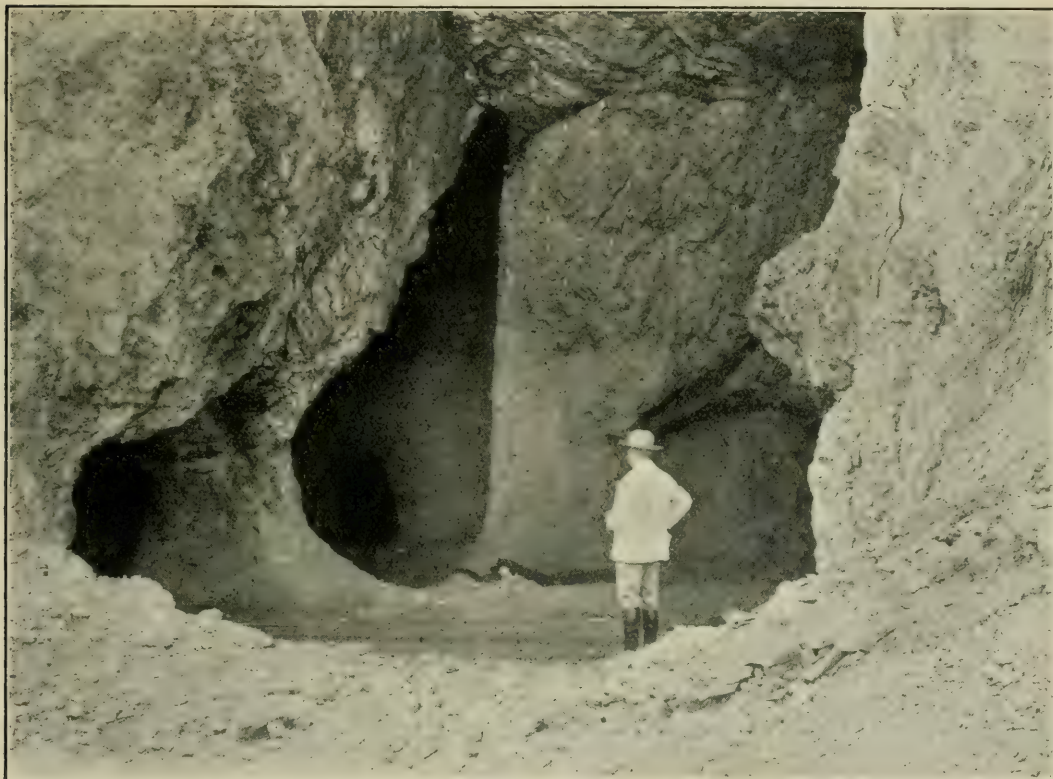
There are two shoots of ore, on different beds of conglomerate, respectively known as the Main and Parallel Reefs. The latter, which was always of low grade, has now become too poor to be worth milling, but the high-grade Main Reef has recently been intersected at the lowest point in the mine, namely the 11th level, and maintains good width and content. The richest ore generally occurs along the foot-wall and is frequently marked by the presence of much visible gold. Where this is not the case, the presence of finely disseminated pyrrhotite is a favourable sign. Massive pyrite is often seen, but must be looked upon, to a large extent, as a secondary mineral, as the lenses that it frequently forms are sometimes obvious replacements of flattened pebbles. Quartz veinlets are a distinctly unfavourable sign in this mine.

ABERCORN 'BANKET.'—The conglomerates at Abercorn have long been known, and I referred briefly to them in my 'Geology of Southern Rhodesia,' published in 1904. It is only recently, however, that any portion of the series to which they belong has been found to carry gold. They are of great apparent thickness, the beds reaching from the Mazoe river to beyond the now famous Lone Star hill, a distance of fully three miles. The strike is approximately east and west, the beds stretching in the latter direction toward Lomagundi, but they are cut off from the rocks previously described not only by the great intrusion of picrite and serpentine making up the Umvukwe hills, but by a considerable stretch of granite. They are, however, quite different in aspect; indeed, the series is predominantly a thick sequence of grits with only occasional bands of pebbles. It would often be difficult, without the aid of the latter, to get an idea of the true strike and dip of the

beds, as there are practically no signs of bedding planes in the grits. Near the Mazoe river the larger pebbles, which are always well rounded, are often about four inches long. On the Lone Star hill, however, at the Shamva mine, they seldom reach greater dimensions than about an inch in length. A slice of a specimen from the No. 2 adit at this locality shows well rounded chert-like pebbles in a matrix chiefly composed of quartz grains. These latter have evidently suffered from

often as much impregnated with pyrite as the matrix of the rock.

It may be noted that the great feature of the Shamva orebody is its remarkable width. This implies that the gold is by no means confined to the pebble bands, which are often only a few inches across. In fact, the occurrence of the gold does not appear to be connected with the presence or absence of pebbles, the intervening grit being often just as rich as the pebble bands themselves. Vein-



ENTRANCE TO STOPE, WANDERER MINE.

crushing and cracking since the original consolidation of the rock. There has been some infiltration both of secondary silica and pyrite, and also of a yellowish strongly refracting mineral, which is probably epidote. There are some grains of feldspar present, and among these a few show microcline structure, though this is rather indefinite and may be not original but due to strain. The chert-like pebbles sometimes have a distinctly banded appearance, and are most probably derived from the banded ironstone series. These pebbles are

lets of quartz and sulphides always appear to be favourable signs of gold in the ore. A plant consisting of Nissen stamps and tube-mills, with a crushing capacity of 50,000 tons per month, is in course of erection, and is expected to be in operation early next year. The Shamva already has ore-reserves amounting to about $2\frac{1}{4}$ million tons, having an assay-value of rather over £1 per ton. If the engineer's expectations are realized, even this grade of ore is expected to yield a profit equal to over half the amount of gold present.

THE ORIGIN OF DIAMONDS

How were they formed? The story of Kimberley. Scientific guesses.
The theory enunciated by Orville O. Derby.

By DAVID DRAPER.

THE discovery of diamonds, in what is now known as 'kimberlite,' has given rise to one of the greatest mining enterprises the world has ever seen. Diamonds to the value of about £200,000,000 sterling have been recovered from the mines of South Africa, and at present the yield is worth over £8,000,000 per annum. Naturally, the discovery of these precious stones, in the original matrix, has given rise to many speculations regarding their origin.

How were they formed? How did they find their way into the serpentinized olivine, which we now call 'kimberlite'?

Previous to the discovery of the Bultfontein mine, in 1869, the world's supply of diamonds had been derived from alluvial deposits only, the principal source of these gems being Brazil, with India and Borneo making a small contribution. The true home of the diamond had not then been discovered. That diamonds were to be found among the glittering quartz pebbles on the banks of the Vaal river was a surprise, and when the searchers found them under the surface, as well as on the ground, all ideas that they had been "scattered about the country by unscrupulous land speculators for the purpose of enhancing the value of their property," as publicly stated by one so-called expert, were dispelled.

Mr. Louis Hond, a diamond-cutter from Amsterdam, then resident in Hope Town, was, however, by no means satisfied that the diamonds of the Vaal were merely chance specimens, brought down by some ancient deluge. He rightly believed that they were derived from actual deposits situated in the valley of the Vaal and its tributaries, and that systematic search would unearth these spots, and he counselled the merchants in the district to instruct their customers to collect pebbles and curious-looking stones, to be submitted to him for examination. During a visit to the village of Jacobsdal in November 1869, he identified, in the presence of the writer, a small diamond in a parcel of pebbles brought by one Cornelis du Plooy, owner of the farm Bultfontein. This farm was purchased a few days later by Messrs. Lilienveld, Hond, and Hurley, who

found on examination that there were many diamonds lying on the surface, the scene of this discovery being at least 25 miles from the Vaal river, and quite devoid of pebbles such as were being found in the river gravels. Hond's theory of a local origin was confirmed. His scheme of turning every farmer family into a group of prospectors was a brilliant idea, eminently successful and most economical. Even with this evidence nearly two years elapsed before any digger was sufficiently inquisitive to probe the beds underlying a thin covering of earth and a few feet of limestone tuff, capping the true diamond-bearing rock, but when at last this was done, the finds increased to such an extent that the alluvial grounds were abandoned in favour of what was subsequently known as the Dry Diggings.

The news of the discovery brought many scientific men, in addition to the crowds engaged in mining and winning diamonds, to investigate what was rightly considered a most wonderful occurrence, and among these were several whose opinions, expressed at a time when the mines were but a few feet deep, were prophetic, notably that of Mr. E. J. Dunn, then Colonial Geologist, who reported as follows: "The diamond mines are inexhaustible, and if water could be obtained in sufficient quantity, they will prove highly remunerative." So also W. G. Atherstone's statement, when he identified the first diamond found in South Africa, "Where it came from, there are plenty more" has been proved correct. Some of the other scientists were more concerned with the origin of the diamond than with the economic value of the deposits, and many weird and wonderful theories were announced. One, that the deposits "were large meteorites which had bombarded the earth." Another, that the "diamonds were derived from vegetable matter growing on the Karroo." And, not the least fantastic, was that of a reverend gentleman, who stated that they were "crystallized angel's tears, shed on account of the cruelties of the Boers to the natives living in the Vaal river valley."

Atherstone ascribed their origin to "the

carbonaceous matter contained in the coal beds which were intersected by the volcanic rocks filling the pipes." This theory was received with a good deal of favour, until diamonds were found far below the coal-bearing horizon, and when other deposits were discovered in the Transvaal, intersecting strata containing no trace of carbonaceous matter, this theory received its death-blow, to be replaced by that of Molengraaff and others "that the element carbon could crystallize into the form known as the diamond under great heat and pressure," and consequently in deep-seated parts of the earth.

Later, Professor T. G. Bonney came to the conclusion that eclogite was the parent rock in which the diamond was formed, his opinion being strengthened by the discovery of diamonds and graphite in boulders of eclogite taken from the Newlands mine. Dr. G. S. Corstorphine, however, opposed this view, and Mr. Gardner Williams having failed to find any diamonds in over 20 tons of eclogite, after careful treatment, this theory did not receive any further support.

From the foregoing, it will be seen that only one investigator, Atherstone, touched upon the source from whence the carbon had been derived.

During the last half-dozen years Dr. Orville O. Derby, State Geologist of the Republic of Brazil, has revived this most interesting subject, and his researches into the existence of carbon in the form of graphite in mineral veins have added materially to what was previously known. Dr. Derby has lately published his views on the genesis of the diamond in the *American Journal of Geology*, Vol. XIX and XX, wherein he puts forward a theory, which is certainly original and highly interesting. In his first contribution published in October–November, 1911, Dr. Derby dismisses the Atherstone theory regarding the origin of the carbon from the carbonaceous rocks in the vicinity of the pipes, though he thinks "the essential part of it—the formation of the diamond *in situ*—is still worthy of consideration if another source of carbon can plausibly be brought into the question."

Accepting the fragmental condition of the mineral forming the pipe-filling, he considers that the origin of the diamonds can perhaps be assigned to reactions between the original rock or rocks constituting the filling and other elements whose introduction was made possible by the fragmenting of the mass, and which accompanied or followed the explosive action if, perchance, they did not constitute

the actual agency that produced it. Pursuing this idea he submits for discussion "the elements of a new hypothesis regarding the genesis of the diamond." A pipe filled with rock fragments saturated with hot (possibly superheated) gases would constitute an enormous crucible in which reactions, not as yet detected in our laboratories, might take place. In this crucible carbon would certainly be present in the form of carbonic acid and probably in other gaseous forms as well. Thus the material and some of the conditions for unusual carbon segregation would be present, for we are not as yet, apparently, in a position to say a segregation of a minute portion of the carbon into a solid form is a chemical impossibility.

In the second contribution (July–August, 1912), Dr. Derby, after studying Fersmann and Goldschmidt's monograph entitled 'Der Diamant,' elaborates their deductions that "all the diamond crystals known to us have been formed suspended in a molten mother liquid (magma)" by provisionally submitting that "diamond crystals have been formed suspended in a medium sufficiently mobile, or susceptible to solution (replacement) to permit their free all-round development." After marshalling some important evidence he places the following summary before his readers:

1. The diamond occurs in the form of isolated complete crystals in a rock of eruptive origin occurring in dikes and pipes, and having the readily alterable minerals olivine and pyroxene as its leading constituents.

2. This rock, wherever diamonds have been found in it, shows evidence of having been fractured after its consolidation to such an extent as to permit a sufficiently free circulation of subterranean solutions, to produce an advanced stage of alteration in all its olivine-bearing portions, so that the only portions that remain perfectly fresh are certain unfractured pyroxene-garnet segregations free from olivine.

3. The circulating solutions introduced water (locked up in the serpentine and other secondary minerals) and carbon (locked up in the calcite) both of which were lacking in the original rock.

4. The circulating solutions attacked the garnet of the enclosed pyroxene-garnet segregations, wherever these were sufficiently fractured to permit it, producing an alteration crust of secondary minerals. Unfractured segregations would naturally be attacked only on their surfaces adjacent to the more fractured and therefore more permeable olivine-

bearing portions of the rock, and thus their (presumably) rounded original form would be accentuated through corrosion, giving them the aspect of water-worn pebbles.

5. After (or concurrently with) the alteration of the garnet, carbon crystallized in the form of diamond adjacent to the secondary crust formed in the former mineral, and, also as Beck demonstrated in his study of the diamond-bearing nodule from the Newlands mine, in the form of graphite.

The conclusion aimed at and submitted for discussion is that "the diamond is a secondary mineral, crystallized out of some carbon-bearing solution that was capable of dissolving the rock (or some parts of it) in which it occurs, and thus of opening a space for it."

"This hypothesis can be easily reconciled with the geological condition in which the diamond occurs in its parent rock in as far as these conditions are known at present."

Those who have studied the structure and mineralogy of a diamond pipe will agree with Dr. Derby in several of the foregoing statements. The majority of the diamonds recovered are in the form of complete crystals, and even those that appear to be fragments of larger crystals may have been produced by spontaneous cracking of the original crystal, a phenomenon by no means rare, as many of the early diamond-miners discovered to their cost. Certainly, the parent rock shows evidence of having been fractured after its consolidation, but throughout its entire mass, and not only, as Dr. Derby states, "wherever diamonds are found in it." In fact, the mineral in barren pipes is just as greatly fractured as that in the producing mines. As a rule the mineral in a kimberlite pipe below that portion which has been subjected to the disintegrating action of surface water and converted into yellow ground, consists of what is known as 'hardibank' and blue-ground, the latter being a softer or more decomposed variety of the former. Hardibank is justly considered to contain fewer diamonds than blue-ground, and, in fact, for many years the former was considered barren, but recently this was proved to be wrong. In the deepest diamond mine worked at present (Kimberley) at a depth of 3000 feet, that blue-ground is still being excavated, and its comparatively decomposed condition is strong evidence in support of Dr. Derby's suggestion, that the rock "was saturated with hot gases and liquids," which, serpentinizing the olivine, rounded off the angles of all the crystalline contents of the pipe, and, at the same time,

formed cavities where the carbon could crystallize. The alteration of the hardibank into blue-ground to a depth of over 3000 ft. below the surface, could not have been brought about by the infiltration of surface waters, and must have been the result of liquids or gases introduced from below. The analysis of a piece of kimberlite from the deepest part of the De Beers mine (over 2500 ft.) gave 2.54% of carbonic acid, a quantity sufficient to produce over 2500 carats weight of diamonds per Kimberley load, whereas the richest mine in the Kimberley group only yielded 1.25 carats per load of 16 cubic feet.

That there should be fewer diamonds in the hardibank than in the blue-ground, is quite a natural result, if Dr. Derby's theory is correct. A lesser degree of permeability would prevent the passage of the gases or liquids, and consequently fewer cavities would be produced. On the other hand, the excessive porosity of the ground would undoubtedly lead to the escape of the gases, and the consequent lack of diamonds in certain deposits, more especially in the upper portions of the pipe, though these deposits may increase in richness at great depth. The greater number of pipes in South Africa are diamond-bearing, though only a few are rich enough to warrant exploitation. Not many are actually barren.

The production of white arsenic in the United States during 1912 amounted to 3141 tons, valued at \$190,757. The whole of this was recovered as a by-product at the smelters of the Anaconda, the American Smelting & Refining, and the United States Smelting, Refining & Mining companies. The imports during the year were 6156 tons. No antimony has been produced in the United States since 1907. Selenium is produced by one firm of smelters from the anode mud left behind in the electrolytic refining of copper. Bismuth is obtained as a by-product by the American Smelting & Refining Co. and by the United States Metals Refining Co. American consumers are chary of buying home supplies as they are not sure of the supplies being regular. If they once bought outside the ring controlled in London and Germany, they would expect to be heavily penalized on returning to the old market. The imports during 1912 totalled 182,840 lb., valued at \$316,440. Bismuth is found in comparatively large quantities in connection with the copper ores of Butte, and some is caught and recovered in the electrolytic refinery. But a larger part is lost in the escaping chimney gases.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Bushvelt Tin Deposits.

The Editor :

Sir—I have read Mr. Weston's letter and your comments in the July issue. Without being able to refer to a previous letter by Mr. Blenkinsop and your remarks thereon (as my back numbers are not at the moment available to me), I should like to say a few words in support of Mr. Weston.

Undoubtedly rock structure has influenced all ore deposits, *cela va sans dire*, but your final sentences are, I think, open to serious objection: "Certainly, they were derived from pre-existing rocks. If not, where from?" This is a cryptic statement, that is liable to misinterpretation, to say the least of it. It might be taken to mean that you advocate the lateral secretion theory for all ore deposits, which I am sure you would be the first to deny. But taken in the sense of your previous sentence: "Ore deposits essentially are reconcentrations, etc.," I must also demur at the word "essentially."

Ore deposits can only be described as reconcentrations in those instances in which secondary processes of solution and re-deposition have been active, and that this is so in all cases, or even in most, I cannot agree with. A recent paper by Messrs. Graton and Murdoch, published by the American Institute of Mining Engineers,* is well worth careful study in this connection, and the method of investigation with the metallographic microscope, which they have adopted for copper ores, might well be applied to other ores, to determine their primary or secondary character. In the meantime, one of their conclusions endorses my preconceived opinion more strongly than any other argument I could use, and I take the liberty of quoting it in extenso :

"Among the ores that we have studied, at least, there are absolutely no indications favouring—rather, there is plentiful testimony against—the hypothesis that many or most orebodies (excluding the enriched zone) are the result of 'repeated reworkings' of their constituents by various processes, of different causes, at separated times or over long-ex-

tended periods. This idea, never ringing true nor supported by competent evidence, has served only to complicate and befog the situation, and thus postpone universal acceptance of the fast-growing and now almost overwhelming proof of the direct and sole influence of igneous agencies in the formation of many orebodies."

W. F. A. THOMAE.

London, August 16.

Oil versus Coal.

The Editor :

Sir—Your own digression from the strict limits of the mining engineer's professional interest in the subject of oil-fuel, which enhanced the value to the lay reader, of your editorial on the subject last month, opens the door for a general discussion that I daresay many of the subscribers to *The Mining Magazine* might welcome.

Next to water, which seems to be necessary to sustain life, there is nothing of greater importance than oil, which bids fair to be essential to the maintenance of civilization. In the importance of lubricant alone, we see a factor of such stupendous moment that the whole fabric of the world, as we know it today, would wither and die were the oil-supply to the journals of our printing machinery and other less important apparatus to be suppressed.

Your own attitude towards the subject, strictly impartial but very critical, as usual, rather, I think, overlooks the already fixed position of oil among the necessities of existence. It appears to me that the proper point of view from which to approach the situation presented by the creation of any new field for the use of oil, is to consider, first, the nature and present position of the particular groups of 'fractions' directly concerned with it.

Petroleum products are so multitudinous and the interests controlling their use so widespread, that it is well nigh impossible for any one man to get a grasp of the subject. Nevertheless, as a fundamental principle, it is certain that the price of any particular petroleum product is very materially affected by the price of others. It may well be, as is, indeed, asserted, that the demand for petrol—to mention

* 'The Sulphide Ores of Copper. Some Results of Microscopic Study.' May 1913.

a product in which I am more directly interested than in heavy oil-fuel—exceeds the available supply, but it must be remembered that it does not pay to mine petroleum solely for the sake of selling petrol, even at 1s. 9d. per gallon. On the other hand, if the demand for a sufficient number of other petroleum products were to increase in proportion to the growing demand for petrol, it might quite well pay to extend the petroleum mining activities, and I should be surprised if the supply were not then found to be in every way adequate to the requirements.

Of course, such development takes time; also, the opening up of new fields is financially risky, and at its best a procedure involving high cost. I am aware that experts have estimated the world's total oil-fuel supply at a somewhat alarmingly low figure, but I am equally impressed by the absence of agreement between them as to the origin of petroleum, and this casts somewhat of a doubt upon the fundamental exactitude of any precise assumption as to its limitations in nature.

The theoretical chemist is prone to regard the formation of oil as the product of the action of steam at high temperatures on metallic carbides in the earth. Prof. Vivian Lewes and others favour the idea that it is produced by the silting over of sea-weed and similar sub-aqueous vegetation. According as one, or the other, or both are right, there is surely a variation in the region and extent of its probable location?

In your editorial you did not touch upon a phase of the petrol question that is of distinct interest to motorists, namely, the synthesis of spirit from fuel-oil and the like, by an exaggerated cracking process in which the oil is passed with water through a heated retort (about 600° C.), and is there dissociated in the presence of a metallic catalyser such as iron or nickel. I cannot help thinking that this may some-day play a part in the treatment of Californian crude oil, and I should welcome the opinion of others on the question as to whether the opening of the Panama Canal is likely seriously to affect the position of the Californian oilfields relatively to the European markets.

That which is the one great stumbling-block, to my mind, so far as we in England are concerned, is the question of freight. We are told to grow industrial alcohol by those who warn us that the oil-supply is doomed to ultimate extinction, but where, I wonder, shall we find the sunshine in our beloved isle to give us home-made spirits in the quantity we need?

And, if we go to our Colonies and protectorates, there is the everlasting question of freight again, and the consequent need for more battleships to protect the transport.

Really, when you come to think of it, we had much better, like the wise virgin, put oil in the lamp while we have any to burn, for I see nothing for it but to emigrate to the equator and keep warm without much clothing when the oilless era at length overtakes us.

A. E. BERRIMAN,

Technical Editor *The Auto and Flight*.
London, August 27.

Has England been Thoroughly Prospected?

The Editor:

Sir—To one who, like the writer, has seen something of mines and ore deposits in various regions, more especially those of the United States, Mexico, and Canada, including British Columbia, on returning to his native country after some years, the question will arise as to whether England has been as fully prospected for its mineral wealth as some countries more recently exploited. Has everything possible to find been looked for, or found, or may there yet be something in store for diligent and systematic prospecting? The impression of a visitor to an old country is that everything seems done, and that people have settled into their groove, and the inhabitants thinking that pretty much everything of value has long since been found and put to its proper use, and that nothing new or startling is to be expected. Is there not a settled feeling that "as it was in the beginning, is now, and ever shall be?" Such is very different from the sentiment that actuates the explorer going into a new and untried region. He is alert to everything; every outcrop may represent something of value, and every likely-looking rock is prospected for what it may possibly contain. Some years ago when on a mining trip through portions of North and South Carolina, I was struck by the immense number of small quartz veins and fragments of quartz, some showing indications of ore, scattered over the cotton and other fields, and over hillside and valley, without any sign of a prospect-hole or any appearance of attention being given to what would have attracted the eye of an average prospector as likely and worth prospecting. In a few rare cases some exceptionally large and prominent veins had been exploited, and mines, some large and profitable, opened up. The reason of this apparent inattention to surface signs was due to the

Carolinas being essentially cotton rather than mining States. Where a vein was opened up into a promising mine it was done by some enterprising individual from the west, such as Colorado, Arizona, or Montana, and the way the mine was opened and the ore neatly laid out and stacked in graded heaps, showed the hand of a westerner who knew his business, not that of a native Carolinian.

That some old countries that have long lost their ancient prestige as ore-producers may yet bear some prospecting and overhauling of old workings is shown in the case of France. Gaul in ancient days was the Roman's Eldorado, but for centuries had lost its reputation among mining countries, and up to the present century there were no mines of the precious metals of any note, although it was known by antiquarians that here and there were evidences of old Roman mining excavations. A mining engineer was recently being shown over an estate by a French gentleman, when his eye was caught by what looked like some old pits, or works, covered with rubbish and brambles. On inquiry, he was told they were supposed to be some old wells. The engineer, going to look at them, picked up some good-looking float, tested it, and recommended the owner of the estate to explore the ground. The result was that today there is a profitable working gold mine on the site of the old Roman diggings. This discovery led the French to investigate the old Roman works, and gave an impetus to general prospecting for gold, which has resulted in the re-discovery and development of quite a number of important mines, so that France may possibly recover its long lost reputation as a mineral region. That England keeps pace with the age in inventions and discoveries is shown by her distinguished band of daring aviators, and, in a mining and scientific line, by the discovery and utilization of vast quantities of radium-bearing ore in the dumps of some of the oldest mines of Cornwall. England has paid great attention for centuries to her noted tin, copper, lead, and iron mines, and to the development of her coal. We can believe that indications of these metal veins have been exhaustively tested, and the extensions of the diminishing coal have been thoroughly followed. But how about gold and silver? Many of the crystalline rocks of Great Britain would seem favourable for the occurrence of these metals, but have they been well looked for, and has prospecting for them been duly done? Perhaps one cause formerly unfavourable to the search for gold was the fact that all dis-

covered gold belonged to the Crown.

In the case of some other mineral products of economic value, we have read of late the discussion about equipping the Fleet with petroleum-burners in place of coal. As a possible future supply of fuel-oil allusion has been made to the flourishing industry of digesting oil and kindred hydrocarbons from the bituminous shales of a part of Scotland. In New Brunswick vast bodies of these shales exist, and though, as yet, they have not been commercially utilized to any great extent, the Canadian Geological Survey has paid them much attention, and exhaustively examined and reported on them. May not such shales of equally good petroliferous quality exist in England, probably well known to the geologists and Geological Survey of this country? Such bituminous shales may be worth considering if our domestic coal supply should fail, or if the foreign supply of petroleum should diminish, or the price of petroleum be raised sufficiently to make the shale business worth while. The writer has been for many years a resident of Colorado, and, as an example of resources neglected, even in America, in case the present oil-wells should give out, he may say that in a part of Colorado, known as the Book Cliffs, he has seen literally mountains of this bituminous shale, any fragment of which will ignite with a match, and from which the bitumen may at times be seen oozing. Yet no attention has been paid to this important deposit because petroleum from other sources is at present so cheap. For the practical utilization, discovery, and development of a country, we must look to its geologists to lead the way; the average layman only makes his discovery by accident or the pressure of circumstance.

ARTHUR LAKES.

Paignton, Devon, August 14.

[Oil-shale of Carboniferous age has been worked in Flintshire for paraffin, as has the bituminous beds of the Kimeridge clay in Dorset. Bituminous clay is found in Lincolnshire. Natural gas has been found at Heathfield, in Sussex, in the Wealden-Purbeck strata. Mr. Lakes might also have mentioned the bituminous shales of New South Wales. A discovery of oil-shale was made recently in the island of Skye by Mr. G. W. Lee, a member of the Scottish Geological Survey. This seam of shale is 11ft. thick and extends over a large area; it is said to resemble the Lothian shale, which yields from 20 to 130 gal. of crude oil and from a few pounds to 60 lb. per ton of ammonium sulphate.—EDITOR.]

Scientific Prospecting.

The Editor:

Sir—It is gratifying to find that my letter on the above subject aroused a little interest. It was a plea for scientific prospecting, and I tried to make clear that this aspect of mining has in the past been greatly neglected by a large percentage of British engineers, and that, in only too many cases, what is wanted is not only, as stated by a later writer, "closer and more scientific observation of the ordinary visible chemical geological phenomena and deductive reasoning therefrom" but the sound geological and chemical training necessary to make these observations.

I write from experience in the field, not as an arm-chair theorist. The old time-honoured methods are not wanted, either in their ragged bush-torn clothes or in a new suit; the time-honoured pluck and determination are required, but armed with new methods. The dowsing rod is old. Emmons methods are new. We want "more critical testing of theories and more exact data." Such work as that of Messrs. L. C. Graton and Joseph Murdoch on copper sulphides must stimulate other workers in the field of microscopic research.

As I pointed out, the scientific prospector can no longer get on without the microscope, which is in fact "following the usual course of events, in which instruments of academic precision gradually create for themselves a field of usefulness in the conduct of business affairs, sometimes becoming of such primal importance that their early beginnings in the laboratory become all but forgotten."⁽¹⁾

Geology, intelligently applied, can see farther than the point of the pick, and has a far greater range underground, in the majority of cases, than any electrical instrument yet invented, the dowsing rod not excepted, if this is an electrical instrument. The limit of casual prospecting has been reached. This happened at the discovery of the Ontario lode, in the Park City district, which was found as "a little knob sticking out of the ground about two inches high."⁽²⁾ Too much is often made of a special knowledge of various minerals. It is possible for any experienced engineer, properly trained, satisfactorily to examine and report upon most ore deposits. A man who understands gold deposits and cannot distinguish cassiterite from tourmaline, ilmenite, garnet, etc., must have been badly trained. The Americans are far ahead of us in their knowledge of ore deposits, and in their ap-

preciation of such knowledge, but why leave this splendid field of work to quick-thinking, hard-working Americans, and plodding Germans? It is a fascinating, useful study, and there's money in it. The London correspondent of the *Mining and Scientific Press* has recently referred to this matter of prospecting, and apparently has come to the conclusion that there is a desire for more money to be entrusted to the rank and file of the profession, by whom he presumably means youngsters fresh from the schools of mines. This would be a mistake, however. Prospecting in the mine or in the jungle should be under the active supervision of men of experience in such work.

The same correspondent writes as follows: "Two or three of the London groups have on occasion embarked on prospecting work, and sometimes with excellent results, as at Mysore and Ashanti . . . Most of these houses are out of touch with the spirit of enterprise required for speculating on a surface indication, and the engineers associated with them, being chary of risking a failure, do not care to recommend a scheme unless it amounts to providing the necessary working capital for extracting known ore. . . . The same caution is usually displayed by companies that have made fortunes out of mines, and wish to continue their organization after the exhaustion of their properties. Two recent examples will suffice. In the first case, an exploration company formed in America reports that several hundred proposals have been examined, and not one proved suitable. In the second case, a company owning what was once a great gold mine has paid attention to sixty proposals with no better luck."⁽³⁾

These remarks are surely an argument in favour of prospecting and of scientific prospecting. I think the promoting houses are not so lacking in enterprise that they will look only at proved propositions, nor are their consulting engineers afraid to advise a fair risk in prospecting, as a fair risk, not as a wild gamble, when there is any promise of finding mines, provided that they like the mining laws in a country and their principals can obtain concessions on favourable terms. The fact is that concessions are increasingly difficult to obtain, and the governments want too much of the prospective profits, while taking none of the risks. Either this or labour is short, or there is no security, all of which facts have to be weighed by the consulting engineers of the promoting houses.

The several hundred proposals rejected by

⁽¹⁾ *London Mining and Scientific Press*, June 7, 1915.

⁽²⁾ U. S. Geological Survey, *Printed paper* No. 77, p. 14.

⁽³⁾ *Mining and Scientific Press*, June 21, 1913.

the American company only indicate that the proposals were unsuitable, not that some of them were not mines in the making. A certain eminent engineer did not think much of the Rand at one time. That "great gold mine" is not yet quite a thing of the past, and of the sixty proposals, were not some withdrawn, and were not others possibly sound small propositions? However, all this only points to the want of more prospecting, and on more scientific lines; the mines are wanted, they probably exist, and grub-staking will not find them. This latter method of prospecting originated in America, and is the last resource of the desperately hard-up, not the deliberate choice of trained men. There may be, probably are, exceptions to this, but there are not enough exceptions to go round.

The aspect of this matter enlarged upon by Mr. Fripp is one among others that I had specially in view when writing my letter, for it very much concerns the prospecting engineer, but I took in a wider field. It has probably been the experience of many of us to see, as Mr. Morton Webber has, a promising young mine temporarily turned down through the wrong man being sent, just as some of us may have seen useless dead-work carried on through the wrong man taking charge, or by reason of some special circumstance not coming under general argument, and so out of place in a discussion.

Successful or unsuccessful management is not a constant factor, but is sometimes governed by circumstances, even by interference and not giving a manager a fair run; and, anyway, being a successful manager does not qualify a man to examine a 'prospect' unless he happens to be well grounded in practical mining geology and has an up-to-date knowledge of ore deposits generally. Practical mining geology does not include the re-construction of skulls from fragments. Judicious hedging is, unfortunately, frequently a euphemism for incompetence, if not dishonest incompetence, and is one of the devices of that sinister anomaly, now happily a rarity, the pseudo-consulting engineer.

As to dowsing, I have had no experience, excepting a humiliating failure in the presence of a small boy, who informed me, referring to my rod, that "we make catapults of those things." However, seeing a book advertised on the subject, I bought it and have read it. The inverted commas in this book⁽⁴⁾ are more than irritating, but there is much interesting

and amusing reading in it, and the author makes clear that dowsing is a gift. It is irregular and capricious, and a person who cannot dowse can prevent one who can from doing it. My failure may have been due to the presence of the small boy, to his inability to dowse, and his persistent inquiries as to what I was doing.

Newton's "flash of intuitive genius" notwithstanding, this is an age of science rather than of mystery, and though most of us speak of Newton with something approaching awe, we cannot be blind to the fact that a few pebbles have been gathered since his time, and if he lived now, I doubt whether he would use a dowsing rod.

STEPHEN J. LETT.

London, August 15.

Coaching at the R.S.M.

The Editor:

Sir—I have been much interested in your comments and Mr. Wraight's letter on the above subject and should like to make some remarks on them. So as to define my point of view, let me state that I left the school three years ago and qualified without any coaching, while twenty months ago for a short time I acted as a temporary demonstrator.

In the main, Sir, I agree with Mr. Wraight's letter, especially endorsing the statement regarding the coaching often necessary for men from the public schools and foreign students who are ignorant, not from lack of ability, but of opportunity, and it is particularly these classes of men who do coach. It seems a pity that coaching appears to have been so abused as to cause comments and letters in *The Mining Magazine*. I have hitherto always regarded your comments as the essence of fairness, but it cannot but be regretted that your attitude in this case seems to be, may I say, somewhat decided on a subject which is at least open to a considerable divergence of opinion regarding its limitations.

In the Chemistry and Physics Departments, if a student enters with little or no knowledge of the subject, then he has until proficient to attend extra classes conducted by the junior staff in the college itself. In Mathematics and Mechanics a student is allotted his class according to his previous knowledge of the subjects. This is but coaching in a mild form and yet with the authority of the respective Departments. Why should not the School of Mines adopt this attitude toward its students who enter badly equipped for scientific studies, and, if necessary, prudently extend it? To my

(4) 'Dowsing.' Thomas Fiddick, J.P., The Camborne Printing and Stationery Company, Ltd.

certain knowledge it has been the policy in the Mine-Surveying course to judge a student as far as possible by his work during the term. In the development of such ideas seems to lie possible remedies for malpractices, on the existence of which you appear to have very definite information.

Who has not tried to find a royal but short road to learning? So long as the examinations are largely essential in themselves for a student to obtain his diploma, just so long will he try to find a short cut to pass them. Generally speaking, however, when a man has grasped the main principles of his subject he recognizes the utter futility of the short cut and depends upon steadily progressive study.

You state that "if a student is too stupid, it is well for him to keep away from a mining and metallurgical career." Is this to read so as to refer to the student being too stupid to pass examinations without coaching? In your various valuable contributions to mining journalism it seems to me the key-note you so often strike is requiring of the profession the application of common-sense, and examination cannot well test that requirement. Therefore may I say, improve the method of training and widening the outlook as much as you will, and judge the student as little as possible by examinations, but should these be unavoidable, let him get through them by whatever legitimate way he chooses. By the time he is twenty he should be old enough to have sufficient common-sense to choose for himself.

Surely, Sir, if a student wants a good place on the pass-lists, and coaching secures that, he is showing business acumen in demanding and getting it. Further he is only following the general practice at the universities and of entrants to the Civil and Military Services.

Your statement that "the internal sources" can affect success at examinations in other ways besides teaching him his subject is a painful slur upon members and former members of the junior staff, some of whom today are men in high positions, and to whom it seems you owe some adequate justification for your statements.

Another statement is that you "believe the junior staff is both inefficient and underpaid and that is why coaching flourishes to a deleterious degree." I emphatically agree that the junior staff is underpaid as compared with the salaries generally attached to mining positions that are attainable by graduates, more especially those with financial influence. Coaching is done entirely by the junior staff. Hence it follows from your statement that the

coaching is done by men "believed" to be inefficient as teachers, and naturally it should be of the same quality as the teaching. Furthermore you baldly label a set of men as "believed to be inefficient"; surely, Sir, this is unsatisfactory and worthy of more solid support than an unqualified statement?

It is helpful to have a suggested remedy, but where in London, Sir, can a student obtain coaching as regards his subjects connected with mining, or even metallurgy, especially compared with the resources to hand at the School? Would you suggest an institution such as coaches for London University examinations and is outside its control? It seems far better to extend the idea recognized faintly in the Royal College of Science courses and provide the extra help where needed by the teachers of the School. This seems to me the obvious remedy—that is coaching, as required to be officially given at the School itself.

In conclusion, the last point of your comments, which if carefully inquired into might prove to be at the root of the supposed inefficiency of the staff, and that is: Is there a sufficient number of teachers on the Junior Staff in posts which may be looked upon as permanent; men proved in technical training and experience, as well as in capability as teachers?

F. C. GOODWIN.

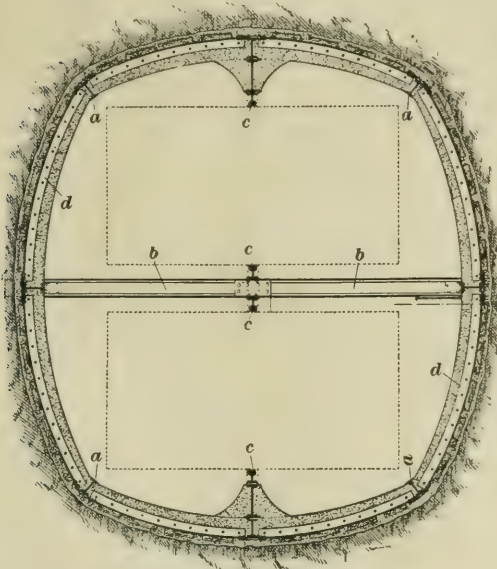
London, September 3.

[We are not sorry to publish this letter, but see no need to argue further. The note on the R.S.M. page of this issue was written before Mr. Goodwin's letter was received.—EDITOR.]

The Nickel Industry of Canada is the subject of a monograph published by the Canadian Department of Mines. It has been prepared by A. P. Coleman, who is an authority on nickel ore deposits and an originator of a theory of their origin. At one time he conducted investigations for the Canadian Copper Company, and he also wrote a report on the subject for the Ontario Bureau of Mines. The chief nickel deposits are at Sudbury, Ontario, where the Canadian Copper Company and the Mond Nickel Company have for some years been engaged in highly profitable enterprises. The Dominion Nickel-Copper Company has been conducting exploration work, and discovered a large orebody in the Murray mine; the ownership has, however, recently changed hands, and the future policy has not been divulged. The Canadian Copper Company a year ago installed basic converters, and the Mond Company has built an entirely new metallurgical plant.

PRECIS OF TECHNOLOGY

Shaft-Linings. — In the *Colliery Engineer* (Scranton, Pa.) for August, Carl Scholtz describes a ferro-concrete shaft-lining used by him at No. 1 shaft of the Consolidated Indiana Coal company, at Dallas, Iowa. The arrangement of the steel is such that the principal members are placed vertically. Eight sets of I-beams (*a*) are used. Two hold the buntons (*b*), and two hold the outer guide-rails (*c*), while the other four are near the outside corners of the cages, as shown in the accompanying illustration. The concrete surface is flush with the inner flanges of the beams. In sinking, the beams are fastened together on the outside by curved angle-irons (*d*) bolted to the flanges of the beams. These angle-irons are spaced about 5 ft. apart, and thin timber lagging is used to prevent falls of the wall. When the sinking is completed, it is



Scholtz's Ferro-concrete Shaft-lining.

concreted from bottom to top. Short form-panels from 3 to 5 ft. high are clamped to the inside flanges of the upright beams, and the concrete poured in. The wooden lagging is not removed, but the concrete passes between and to the back so as to give a firm bed for the structure against the walls. The advantage of this steel and concrete combination is that the structural steel can be put in with little expense, and without requiring skilled labour. Sections are bolted together with fish-plates, and each section is self-supporting by having a brace rivetted to the outside of the I-beam, resting in the rock or supported by a shore or prop safely embedded in the shaft wall. By this means not much attention need be given to the plumbing of the shaft as it goes down, because the steel frames can be shifted in the proper position just as the concrete is put in. The old method of putting in concrete shafts by the use of wooden forms is complicated, and requires much skilled labour, besides involving delay, because the forms must be carefully set before the concrete is poured, in order to have the required alignment for guides and buntons. In the Dallas shaft the vertical I-beams were made in 15-ft. sections. In soft material a blind ring slightly

larger than the completed shaft was used to permit lagging down to the bottom of the excavation. When the proper depth was reached, and permanent steel frame was installed, the temporary rings were removed, and the lagging adjusted itself to the permanent bolts. The weight of material in this construction, including 45-lb. steel rails for guides, and $\frac{1}{4}$ -in. reinforcement rods 6 in. apart, is about 165 lb. per foot of shaft.

Persistence of Gold Ores in Depth. — In the *Mining and Scientific Press* about a year ago, Malcolm MacLaren contributed to the discussion on the persistence of ore in depth. He has now presented a fuller exposition of his views in a paper written for the International Geological Congress, held at Ottawa in August. He begins by defining 'depth' as the zone below oxidation and secondary enrichment, extending down to 6000 ft. below surface, containing primary ore alone, the lower limit being arbitrarily fixed as the lowest at which it is possible to work an ore deposit. The ore in this zone may be assumed to have been deposited during a single short geological era, and to owe nothing to accretions of a widely-separated and later period. It is probable that the irruption of auriferous solutions was normally paroxysmal in character, and comparable to volcanic eruptions of the present day. Only those fissures and channels that were open at the geological moment were filled with ore. This assumption may help to explain the vertical variations in the tenour of the ore in the primary zone, and the bands of richer and poorer ore found in many mines. These alterations conceivably represent the varying horizons at which successive upward pulsations of metalliferous solutions either became sufficiently cool to be deposited or met with fluid agents of deposition.

Mr. MacLaren gives a revised form of his classification of gold deposits of the world. The first division consists of deposits in pre-Cambrian rocks and includes those found in West Australia, India, Transvaal, Egypt, Rhodesia, Guiana, Brazil, Eastern United States, and Eastern Canada; these deposits arose as the end-product of a diabasic magmatic-differentiation series intrusive into schists. The second group are probably of Permo-Carboniferous to Post-Jurassic age, and are found in (1) the Urals, (2) Eastern Australia and Tasmania, and (3) Western North America (California, Oregon, and Alaska); these arose as the end-product of granodiorite intrusions. The third group are of Middle Tertiary age, and are associated with andesite volcanic eruptions; they are found in Northern Chile, Peru, Colombia, Mexico, California, Nevada, Utah, Colorado, Unalaska, Japan, Sumatra, Celebes, New Zealand, and Transylvania. The pre-Cambrian and Tertiary groups are well defined. The other is not so definite and is separated into three subdivisions; in all probability further knowledge will cause modifications in the classification of the members of the group.

The outstanding feature of the Tertiary group is its association with the circle of present volcanic activity round the Pacific ocean, and the similarity of the methods of formation of the vein-matter with similar actions observed at the hot springs now flowing. The orebodies of this group are irregular in form and tenour, and great persistent fault-fissures are unknown. The fissures appear to be local tension fractures, due sometimes to cooling, so that they are limited in lateral and in vertical extent. When two or more local series of fractures intersect, the deposit becomes a stock-work, and if the veins are close together a rich deposit may be found. The original irregularity of the veins is accentuated by the selective action of auriferous

solutions replacing the fissure-walls with ore. No Tertiary goldfield has carried its bonanzas to great depth. By far the deepest is the Comstock, where, though ore is found at 3300 ft., nothing is found that can compare with the rich ore raised from the 1000-ft. to 1800-ft. levels. Only a few mines have carried rich ore below 1000 ft., and even these have been characteristically uncertain as to persistence. The cause of lack of persistence may be due to the passage of the lode from the andesite to the basement rock, or to the approach to the bottom of the fissure of tension, but in a great many cases where a lode persists but its content does not, these explanations do not apply. For instance, the Martha lode-fissure at Waihi is as well defined as ever at 1000 ft. Below that level the gangue is calcite, and above quartz. The gold content suddenly diminishes in the neighbourhood of this change in the vein-matter. It may be supposed that the lode was originally calcite and that it was attacked above 1000 ft. by solfataric water containing silica and gold.

The cause for the general diminution in gold content in comparatively shallow levels in Tertiary orebodies was explained by Mr. Maclaren in his book on 'Gold' to be due to the nature of the solution holding the gold. He takes it to have been an alkaline auro-sulphide, from which the gold was precipitated not by pyrite or other sulphides but by the cooling of the rising solution. More recently, Victor Lenher has shown the alkaline sulphides to be carriers of gold, and acid water and exposure to oxidation to be efficient precipitating agents. Both these agents may be assumed to operate only near the surface, especially in volcanic regions.

Thus in Tertiary goldfields it is unsafe to assume the existence of any ore below what has been actually developed.

In the second group, those connected with granodioritic intrusions, the East Australian and West American provide the most interest. Those in the Urals are too little known to provide useful data. The deposits in the eastern cordillera of Australia are dependent on the granodioritic intrusions that have taken place along an axial line of earth-folding. Gold-quartz veins are found either in the igneous rocks or in the sedimentary strata overlying or adjacent. In the north the gold deposits are usually found in the granitoid rock, and in the south in the sedimentary rocks. The intrusion probably occurred in the late Permo-Carboniferous. All adjacent strata of greater age may therefore carry auriferous veins. The general experience is that the tenour of the ore decreases in depth, but the conditions are such that little information is provided by the natural occurrences, upon which to base any theory or rule. In the West American region, the Mother Lode of California and the Alaska Treadwell mines form the most characteristic examples of this group. Mr. Maclaren has been unable to find any evidence of general diminution of content in depth in the Mother Lode. In many cases a lode may become impoverished, but concurrently a parallel lode is found that continues to yield ore in depth. He advises that cross-cutting should become more general in this district. The Alaska Treadwell mines are at too shallow a depth to help in the present discussion. Generally speaking, in connection with this group, Mr. Maclaren considers it justifiable to count on extensions below ore developed.

The third group in the classification, including the goldfields of the pre-Cambrian age, contains the most important mines at present worked. Those in West Australia, Southern India, Egypt, Rhodesia, and the Transvaal, present many types of similarity and are

considered to form a single metallogenic province. The Kalgoorlie goldfield has been studied closely by Mr. Maclaren. The area is one of ancient schists (mainly calc-schist) through which a quartz-dolerite magma with its differentiation products have intruded. The differentiation sequence appears to have been quartz-dolerite (quartz-diabase) followed first by members as basic as peridotite and then by more acid segregations ranging through porphyrite to final albite-porphyry, the last being often intrusive through the quartz-dolerite. Auriferous impregnation followed closely on the intrusion of the albite-porphyry. Rich lodes have been developed only in shear-zones in a broad dike of quartz-dolerite, the shear-zones being barren when they pass in depth or in linear extension out of the quartz-dolerite. Since the shear-zones are, when considered over depths of 3000 ft., approximately vertical, and the quartz-dolerite dike which is parallel to the strike of the shear-zones dips west at 65°, the shear-zones pass in depth out of the dike, the eastern shear-zones with their contained lodes reaching barren ground sooner than the western. Kalgoorlie, therefore, well illustrates an outstanding feature of all goldfields, except indeed some in the Tertiary group, namely, that non-persistence of ore in depth is a function not of depth but of geological structure. In Kalgoorlie three well-defined parallel shear-zones may be identified. Taken severally and having regard to the depth factor alone, they show (a) non-persistence of ore in depth (Australia East and Lake View-Perseverance lodes), (b) persistence of ore in depth (Great Boulder and Ivanhoe-Horseshoe lodes) and (c) a probable enrichment in depth (Ivanhoe West lode). Generalizations based on the depth factor alone when geological conditions are unknown are misleading. T. A. Rickard, for example, has relied on the evidence furnished by the failure in depth of the eastern lodes and an impoverishment in the Ivanhoe mine at 2500 ft. to support a general theory of impoverishment in depth. W. L. Garrison also quotes the Ivanhoe impoverishment as possible evidence of non-persistence in depth. The Ivanhoe impoverishment does take place, but it is local and is due to the fact that the vertical Ivanhoe lode here passes through a thin albite-porphyry dike dipping west about 65°. The great Boulder lode passed through the same dike with local impoverishment at 2200 ft. When, however, the latter lode was encountered beneath the albite-porphyry dike it proved as rich as in the upper levels, and the same result may reasonably be expected in Ivanhoe deeper levels. So far, then, as the evidence furnished by Kalgoorlie goes, it indicates that, so long as its lodes remain in quartz-dolerite, so long will they furnish ore equal in tenour to that found from the 500-ft. to the 2000-ft. levels. The Horseshoe-Ivanhoe group of lodes may therefore be expected to carry ore to the 5500-ft. level, provided always that the quartz-dolerite dike persists, does not flatten in dip, and is not thrown westward in depth by westerly dipping reversed faulting.

Pre-Cambrian strata, from the vicissitudes to which they have been subjected in the course of long geological ages, are normally much folded and disturbed, while lode-fissures in them are nearly vertical. It is a fundamental axiom in these older deposits that the nature of the lode wall exercises a vital influence on the richness and sometimes on the mineral character of the orebody. Hence it rarely happens that a great depth is reached before the lode, worked from the outcrop downward, has passed out of the favourable rock. A notable exception is the Champion lode of the Kolar goldfield, southern India, probably the richest single

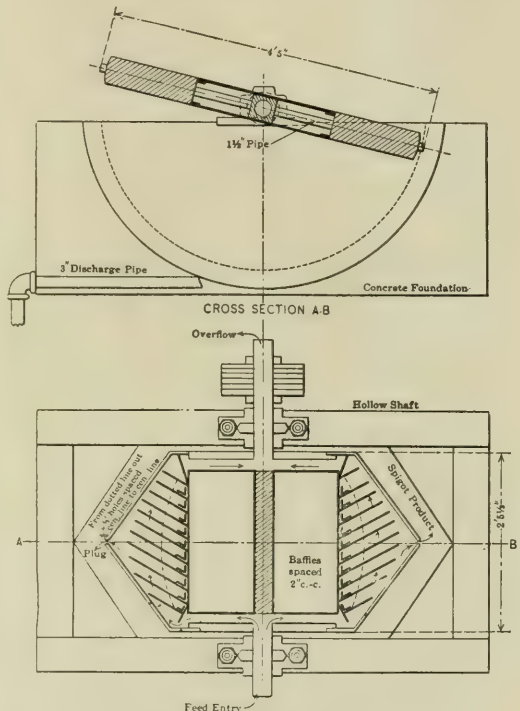
gold lode ever worked. From 3200 to 3800 ft. ore as rich as any obtained in the upper levels is now being worked and ore may be expected to persist in this fissure as long as it remains in the favourable hornblende-schist.

The greatest goldfield of the world, the Witwatersrand, responsible for 37% of the world's gold production, is a pre-Cambrian goldfield, but the criteria of ordinary pre-Cambrian regions do not apply to it. Its deposits lie in sedimentary quartzites and conglomerates and are undoubtedly decreasing in tenour in depth. Having regard to all the geological conditions surrounding auriferous deposition on this region, it may be assumed that its gold was deposited relatively near the then existing surface and that deposition was due either to cooling on approach to the surface or to admixture with oxidizing waters, which in basin-shaped sedimentary areas as those of the Witwatersrand, may reach to depths of several thousand feet. The surface of most pre-Cambrian goldfields, on the other hand, has been subjected to erosion during a large portion of geological time, and the locus of gold deposition, though now comparatively near the surface, was at the period of impregnation many thousands of feet below the then existing surface and beyond the reach of oxidizing waters, perhaps even beyond the influence of thermal changes.

Kirkland Lake, Ontario.—In the *Canadian Mining Journal* for July 15, R. E. Hore describes the geology and mining at Kirkland Lake, the newly developed gold-mining district in Ontario, which is attracting attention owing to the rich ore found at the Foster-Tough-Oakes property. Kirkland Lake is near Swastika, on the Temiskaming and Northern Ontario Railway, north of Cobalt and east of Porcupine. The gold is found in narrow brecciated quartz veins enclosed in reddish-grey felspar-porphry, grey conglomerate, and grey ferro-dolomite. The gold occurs native and as telluride. Coarse particles of gold are plentiful in the fracture planes of the quartz veins. The telluride is in the form of imperfectly crystallized grains of a greenish bronze colour, probably being calaverite. Both the free gold and the telluride are found in the wall-rock as well as in the quartz veins. A large amount of graphite is present with the gold. A common mode of occurrence of coarse gold is on fracture faces or walls of quartz veins that are black with graphite. In several cases there are slickensided black walls spotted with small flakes of gold. Pyrite is also abundant. Much of it is in the form of very small grains, not in contact with one another, but scattered throughout the wall-rocks. Some specimens show gold grains entirely enclosed in calcite. The wall-rocks have been greatly fractured along zones rather than broken by extensive fissures, and prior to the intrusion of the quartz and the gold. The veins are often mere veinlets, and, owing to their similarity in colour to the porphyry, are easily overlooked. The porphyry varies in character, but generally some member of the felspar series is the most conspicuous mineral. The rock is very hard and difficult to drill. On the other hand the conglomerate is easy to mine and development is preferably done in it. The conglomerate is in some respects similar to that found at the Dome mine, Porcupine. It is grey and schistose, with numerous pebbles of porphyry, greenstone, and chert. It differs from the Dome conglomerate in containing red jasper pebbles, and in being highly fractured. The fractures are often filled with quartz or calcite. They go right through the individual pebbles and quartz grains. The conglomerate shows distinct bands of coarse and fine portions, and the gold is as-

sociated chiefly with the coarser bands. The conglomerate and porphyry beds dip steeply, the former under the latter. The richness of the outcrop may be judged by the fact that the first ore shipped averaged 20 oz. gold per ton. Tests show that 75% of the gold can be recovered by amalgamation. A 5-stamp mill has been erected.

Kuchs-Laist Slime-Thickener.—In a paper presented by Ralph Hayden at the Butte meeting of the American Institute of Mining Engineers, describing the various plant tried at Anaconda for the treatment of slime, an account is given of the Kuchs-Laist centrifugal machine, which has for its object the removal of



Kuchs-Laist Slime-Thickener.

colloidal matter and excess water, and the production of the granular material in a form suitable for concentration. This machine consists of a set of radial chambers mounted on a hollow horizontal revolving shaft. At the outer end of each chamber is a plug, through which is discharged the heavier material settling in the chambers by centrifugal force. The slime is fed at one end of the hollow shaft, and passes to the chambers, which are provided with baffles. These baffles serve to check the flow of material, and direct the heavier part to the point of discharge. The overflow passes out through the other trunnion. In the illustration, the machine has only two chambers, but ten more could easily be added, radiating from the central shaft, and thus greatly increasing the capacity. The speed of revolution is from 640 to 1200 r.p.m. The chief mechanical difficulty has been the provision of suitably hard material for the manufacture of the discharge plugs; finally alundum was employed. The aperture in the plugs quickly enlarges with wear, so that the specific gravity of the discharge is variable. The machine requires an undue amount of power. Its chief virtue is the removal of colloidal matter.

Mining Methods at Cobalt.—In the *Canadian Mining Journal* for August 1, Reginald E. Hore writes about methods adopted at Cobalt for mining the narrow lodes of rich silver ore. In the early days open-cuts were general. The rock on one side of the vein was broken and removed, and the vein-matter picked off the wall and bagged. Many open-cuts were worked to depths of 50 or 100 ft. It was not for a long time that shaft-sinking and driving were commenced, and even then it was usual to leave the vein on one wall and collect the ore in bags. In this way much fine rich ore was lost in the broken rock and removed with it to the dumps. Things have greatly improved since then. The present practice in development is to sink vertical shafts in the veins, and drive at intervals never less than 100 ft. and often 50 or 75 ft. Other veins are reached by cross-cuts, and developed by winzes and drifts in a similar manner. At most mines there is a central hoisting shaft. Instead of leaving the vein on the wall, it is now usual to keep the vein well within the working face. The rock on each side for a few feet contains enough silver to pay for milling. In some mines, care is taken to keep the rich ore separate, while at others everything is mixed and hoisted to the surface where it is picked, jigged, and tumbled.

In stoping, some mines use the shrinkage system, but at others stulls and lagging are put at short intervals so that little ore shall remain in the stopes. At the Crown Reserve, square-set timbering is employed. Good examples of the shrinkage system are provided by the Nipissing and Coniagas mines. At Nipissing, drifts are run 14 ft. high and 5 ft. wide. If the walls consist of milling rock, or if there are two or more veins close together, the drifts may be wider, in some cases as much as 12 ft. The veins are kept well within the breast. The drilling for the whole 14 ft. is done from one set-up, so each set-up is for an advance of 5 or 6 ft. with a height of 14 ft., and a width of 5 to 12 ft. A cut 8 ft. high is taken 5 or 6 ft. in advance of the remaining 6 ft., which is drilled by uppers. The level is protected by a lagging of poles laid on caps supported by posts. Chutes are built at intervals of 25 ft. Before stoping a large block, rises are cut into the level above. These are cut by two men using small stoping-drills. A man-way is constructed by timber partitions, and the remainder of the rise is filled with ore as it is broken. The miners work on a platform which protects the man-way and extends across the broken ore. To maintain the desired working space, ore is drawn off from a chute at the bottom of the rise. This chute is afterwards used for ore from stoping. When the rise is completed, it is used to provide a stoping face, and the ore is broken on each side. The rise provides ventilation, and it is used to lower steels and as a man-way. The high-grade ore is not kept separate. The cars are taken to surface on a cage.

At the Coniagas, the methods of development and mining are similar to those at Nipissing, with some variations. The drifts are run 8 ft. high, and are afterwards enlarged by a cutting-out drift, giving 8 ft. additional height. The lagging is supported by stulls set in hitches. Where the drift is wide, posts are used to support stulls in the middle. Chutes are built at intervals of about 25 ft. Stoping is begun by breaking some ore carefully on to the lagging, and is then continued by the shrinkage system. In order to avoid pot-holing and sledging of large pieces of rock, care is taken to break the rock comparatively small. Much high-grade ore is picked underground. In the drift-stopings, a sorter examines the ore as it is loaded into

the cars and bags the best quality. In the stopes there are no sorters, but the miners themselves sort as much high-grade ore as possible. It will be seen that while at Nipissing the sorting is done at the surface, at Coniagas it is largely done underground.

Hardinge versus Chilean Mills.—At the Butte meeting of the American Institute of Mining Engineers held in August, Robert Franke, of Miami, presented a paper giving the results obtained by Hardinge mills side by side with Chilean mills, used for obtaining a product suitable for table concentration from the ore at the Miami copper mine, Arizona. The ore consists of a hard fissile schist containing finely disseminated granular chalcocite. When the concentrating plant was erected, it was decided to use Chilean mills to follow gyratory crushers and fine rolls, and thereby to reduce the whole of the ore to less than 30-mesh before starting concentration on sand and slime tables. The claims of the Hardinge conical mill were not overlooked, and one section of the plant was equipped with them. We may mention here that a description of the Miami concentrator was given in our issue of September 1910. Mr. Franke in the paper now published gives the comparative results obtained by the two types of mill, and in every detail the advantage has been proved to lie with the Hardinge.

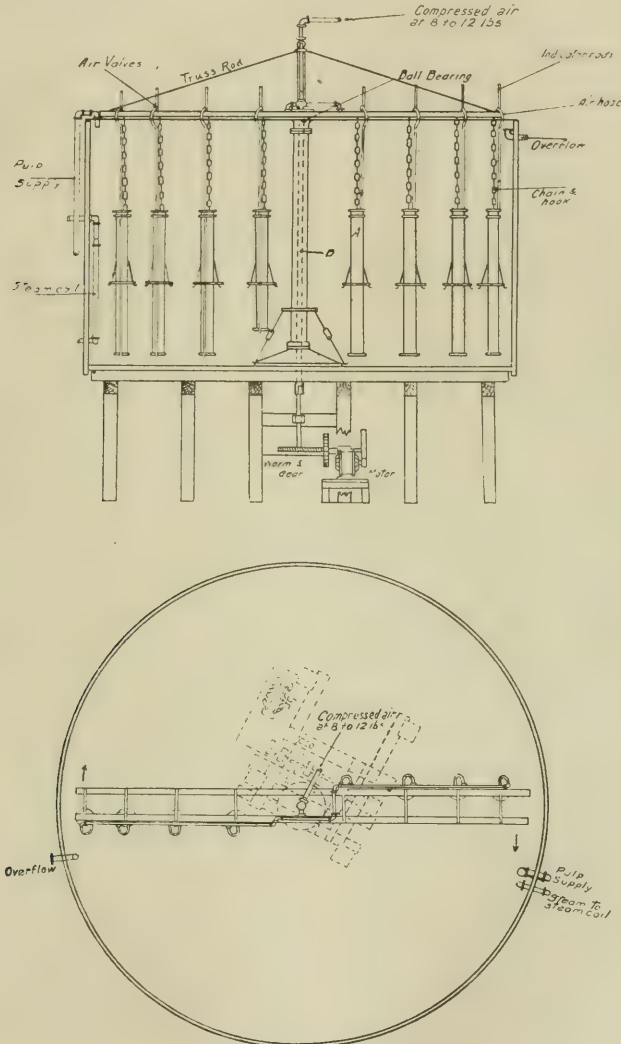
The Hardinge mill employed is 8 ft. long with a central cylindrical portion 22 in. long. The cylindrical portion is lined with cast-iron liner plates, and the conical portions are lined with silex bricks bound together with cement. Each liner plate carries a projecting lifter, the function of which is to increase the height of drop of the lifted material. Danish No. 5 pebbles are used in grinding. The Chilean mill is a fast-running, 3-roller, 6-ft. Saturn mill, with screens having an opening of 0.037 in. The feed consists of the oversize of Callow screens having an opening of 0.029 in. which follow the fine rolls. The advantages obtained by the use of the Hardinge mill are: Smoothness and regularity in operation, delivery of a product conducive to better extraction on the tables, economy in water consumption, lower operating and maintenance costs, and a low rate of depreciation. Regularity in operation is effected by simplicity of construction, such items as discharge-screens, dies, and mullers requiring renewal being eliminated. The delays at the Chilean mill were 2.11% and at the Hardinge 1.29% of the time. Of these the delays in the Chilean mill were as to screens 0.57%, and as to repairs 1.54%, and of those in the Hardinge 0.71% as to re-lining and 0.58% to repairs. The time lost in re-lining the Hardinge mill is due to the necessity of allowing the binding cement to harden for 48 hours. This delay can be eliminated by having extra shells that can be fixed in place of a worn shell in less than 2 hours, and under these circumstances the total loss of time would be only 0.6%. Less attendance is required for the Hardinge; occasional pebble-feed, lubrication, and a watch for obstructed discharge-boxes are the only services necessary. Thus the labour-cost is reduced.

With regard to the comminution of the ore, it is found that the best concentrating results are obtained if the amount of material from 60 to 200 mesh is a maximum. From screen-analyses it was found that the Hardinge product contained 37% of this material and the Chilean 25.6%. As regards power consumed, the Hardinge took 9.6 horse-power-hour per ton passed through, and the Chilean 10.7 h.p.-hour. The cost of maintenance worked out at 7.09 cents per ton of feed with the Chilean, and 6.36 cents with the Hardinge, a saving of 0.73 cents per ton. Of the Hardinge cost, 4.56 cents is the cost of pebbles, 3.51

lb. per ton of feed at 1.3 cents per lb. The most important item, however, in favour of the Hardinge is the longer life of the machine, and the consequently lower charge for depreciation. With Chileans it is necessary to charge 4.2 cents per ton of feed, and with a Hardinge only 0.7 cents, showing an advantage of 3.5 cents.

The Symmes Agitator.—In the *Mining and Scientific Press* for July 19, Whitman Symmes describes

way as to remain vertical during the revolution of the arm. The rate of revolution is $1\frac{1}{2}$ times per minute. Each air-lift consists of a tube and nozzle, and the compressed air is supplied through a hose-pipe connected with a pipe-union above the pulp. When the pulp becomes packed on the bottom of the vat, the air-lifts drag, and cut their way down through it. A rod rising from each tube indicates whether it is in a vertical position. If power is off for a long time, the



THE SYMMES AGITATOR.

his agitator for slime installed at the Mexican mine, Nevada. Mr. Symmes found that the Trent agitators installed did not give satisfaction owing to the impossibility of re-starting them. He therefore removed the stirring arms and pumps, and substituted a number of air-lifts flexibly suspended from a horizontally revolving arm. The accompanying illustrations show the arrangement. The revolving arm is mounted on a central vertical standard and is driven by gear from below. The air-lifts are suspended from the revolving arm by means of chains, and are balanced in such a

way as to remain vertical during the revolution of the arm. When power is again available, the tubes are lowered gradually, cutting their way down to the normal position. Extra pipes would be necessary for agitating a partly filled vat, but at the Mexican mine continuous agitation is employed so that such a device is unnecessary. The only part requiring repair is the rubber sleeve of the air-nozzle used to prevent a flow of pulp into the air-pipe if the air-supply should fail. This form of agitator has been in continuous use for over six months without any interruption, and the cost of power is small.

Precipitation of Copper from Mine Water at Butte.

At the August meeting of the American Institute of Mining Engineers, J. C. Febles presented a paper on the recovery of copper from mine waters in the Butte district. It is often alleged that copper in the mine waters was allowed to be lost in the early days at Butte, but this statement is made only by people who forget that the mines in this district were originally worked for silver, and that copper ores did not commence to make their appearance in appreciable quantity until a depth of 400 to 500 feet was reached. The first production of precipitate was in 1890. At the end of the preceding year, the St. Lawrence mine was flooded in order to extinguish a fire, and the water, subsequently removed by pumping, was allowed to flow down the hillside into the river. In its course, the water flowed through ground belonging to a man named Miller, who enlarged the ditch and placed scrap iron there. The precipitate obtained was sold to the Colorado smelter. In the same year, William Ledford secured a lease of the mine waters, and for some years made a substantial living. On the expiry of the lease, the Anaconda company continued his work, and the other companies in the district added similar plants. In 1901 the Anaconda built a new precipitation plant in a situation convenient to take the water pumped through the High Ore shaft. At first an attempt was made to recover the copper by lime, but the precipitate was flocculent and of low grade, so the standard method of precipitation by iron was adopted. Other similar plants, the Leonard and Silver Bow, have since been erected.

Mr. Febles proceeds to describe the High Ore plant, as at present working. The amount of water flowing averages 1200 gal. per minute. The average copper content is 0.05%, and the extraction is 98.6%. The temperature of the water issuing from the mine is 85° F., and after passing through the precipitation plant 54° F. On leaving the mine, the water passes through the first set of flumes, three in number, parallel to each other, each 4 ft. wide, 2 ft. deep, 300 ft. long, with a fall of 2%. These flumes are filled with scrap iron such as rails, pipes, rods, and bars. The iron is continually turned over in order to dislodge the precipitate. Every few days one of the flumes is cut out of circuit, so that the iron may be temporarily removed and the precipitate washed into the settling tanks at the end of the flumes. The water afterwards passes down a second series of flumes, 8 ft. wide, with an incline of 2½%, and length of 500 ft. Along these flumes there are settling tanks spaced 75 ft. apart. The settling tanks are large wooden boxes, of the same width as the flumes, about 15 ft. long and 8 ft. deep, and so arranged that the precipitate can be sluiced through a hole in the bottom into drying vats. After passing through the flumes, the water goes to a tower, consisting of a heavy wooden frame filled with scrap iron too big for use in the flumes. This tower is 130 ft. long, 8 ft. wide, and 19 ft. high, with a settling tank extending the whole distance beneath it, and provided with baffle-boards at the sides to prevent the escape of splashing water. The water is then sent to another tower, and afterwards to two parallel flumes, 9 ft. wide by 300 ft. long, filled with tin cans and small scrap. Thence it goes to a series of five towers, and after passing settlers runs to waste. The figures given by Mr. Febles show that 95% of the copper content is recovered in the flumes before going to the first tower. So that the towers, subsequent flumes, and second set of towers yield very little. The cost of producing this copper is estimated at under 5c. per lb. The Leonard plant takes 1500 gal. of mine water

per minute, and the Silver Bow plant 350 gal. per minute, the results obtained being much the same as at the High Ore plant.

Mr. Febles gives the result of his experience in connection with the quality and disposition of the scrap iron employed in precipitation. Almost any merchant iron or mild steel will give satisfactory results, provided its surface is kept clean. The results obtained by the use of hard steel, or spring steel, are not so good. Cast iron is the poorest of all, having little or no value for precipitating. The uncombined carbon in the cast iron seems to interfere, to a marked degree, with the reaction. The copper adheres strongly to the surface of the cast iron, making its removal so difficult that the surface cannot be properly cleaned. After the copper coating has become thick it will break off in hard flakes and scales, with pieces of carbon adhering to them. The best iron for the purpose seems to be old rails, merchant bar, and pipe of small diameter. Horse-shoes, punched screen, heavy sheet-iron, nails, bolts, and iron wire are good; roofing iron, tin cans, and similar scrap are not so good, but are extensively used because they are plentiful and cheap. All paper should be removed from cans before using. Painted iron and galvanized iron should be burned before using; in fact, annealing at a low temperature improves almost any iron for the purpose of precipitation.

Care should be used in the distribution of the iron, in order to secure the maximum precipitating surface. It should be packed closely, but in such a manner as to allow the water to flow freely. Rails, pipe, and bar iron should be placed horizontally in the flume, with short transverse pieces between the layers, to allow space for the free flow of the solution. Material of this kind can be used to the best advantage in the upper part of the system, where the flow is most rapid and the water richest in copper. Smaller scrap and cans may be placed indiscriminately. Flat sheets should be placed one above another, with enough small scrap between to prevent interruption of the flow, and in such a way as to present the maximum surface. Where rails, small pipe, and bars are used, and the flow is sufficiently rapid, little or no handling of the iron is necessary, an occasional sweeping with a stiff brush being sufficient. The precipitated copper, thus freed from the iron, will be carried to the settling-tank below. The smaller scrap, sheets, wire, and cans, should be turned over occasionally with hooks and rakes in order to remove the precipitated copper.

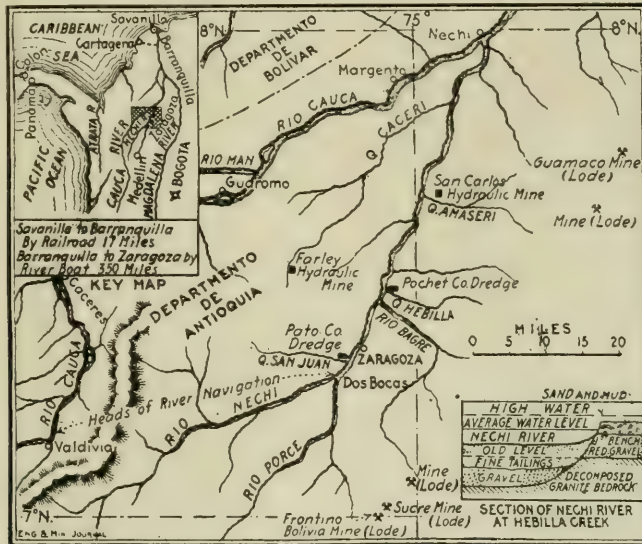
Size of Tube-Mills.—In the *South African Mining Journal* for July 26 and August 2, information is given as to the dimensions of tube-mills employed on the Rand, pointing to the tendency to gradually diminish the length. The standard tube-mill adopted by most of the leading houses has been 22 ft. by 5 ft. 6 in., and it is usually assumed that smaller ones had not been used until the Barnato group erected tube-mills 16 ft. 6 in. by 6 ft. at the new installations at Consolidated Langlaagte and Van Ryn Deep. It is, however, pointed out that the Albu group early adopted tube-mills of shorter length. They were pioneers in introducing tube-mills on the Rand, and their first was erected at the New Goch mine in July 1903. This measured 24 ft. in length and 5 ft. in diameter. As a result of observations and experience, the next ordered, for the Meyer & Charlton in 1904 and 1905, were 16 ft. 6 in. long, and the second ordered for the New Goch was also 16 ft. 6 in. long. A careful comparison of the results obtained from the two mills running side by side at New Goch showed the results in quan-

tity and quality of grading to be practically identical, and that a saving was made of 35% in the consumption of power in the short mill. Twenty-two tube-mills have since been installed by this group, all of the smaller size.

Colombian Placers.—In the *Engineering and Mining Journal* for August 16, William F. Ward gives some information relating to the dredging and hydraulicking work at present being done on gold placers in the Nechi River district, Colombia. Owing to the Oroville Dredging Company being one of the operating companies, the article is of interest to English readers. There are four centres of activity at present, two being dredging propositions and the other two hydraulicking. The dredges are owned by the Pato and Pochet companies respectively, the former being the subsidiary of the Oroville Dredging. The hydraulic

L. D. Pochet, is a resident at Barranquilla. He bought the dredge from previous owners who had failed in making it a success on other properties. It is not possible to work at night owing to the occurrence of buried timber. Mr. Ward does not give figures for gold content or for cost, but states that the yield per yard is higher than is obtained from any dredge in the United States. Woollen blankets are used next the screen for the purpose of catching fine gold that would not be arrested by the mercury.

The Farley hydraulic mine is situated in the upper part of Caceri creek and is worked by an American. Two monitors are employed, and though the content is low, a fair profit is made. The San Carlos mine is 2 miles up Amaseri creek, and was worked for some time by a French company without success. It is now in the hands of a small owner in Zaragoza. There



THE NECHI RIVER DISTRICT, COLOMBIA.

mines are the Farley and San Carlos. The positions are shown in the accompanying map. The Pato company owns extensive tracts of land on the west side of the Nechi river from San Juan creek to a point opposite the mouth of the Bagre river. The dredge has 9 cu. ft. buckets and is operated electrically. It started on January 2 of this year, but an accident delayed regular work until the end of February, since when it has been operating satisfactorily. The dredge would have started a year earlier had it not been for the difficulty experienced in building a safe dam across the San Juan creek for the hydro-electric generating station. The first stretch of ground to be treated consists of 300 acres, proved by drilling to contain 31 cents gold per cubic yard. This is chiefly on the first bench of the Nechi river. The bedrock of this bench is at about the level of the river, and the dredge is able to start work in Pato creek and work up into the bench gravel. There is an older and higher bench that has been partly worked by native methods. This will probably be worked by sluicing, making use of the surplus power of the electric plant.

The Pochet company has been working a Werf-Conrad dredge near the mouth of Habilla creek since 1909. It has 5 cu. ft. buckets and is steam-driven. The labour employed is entirely local, and the owner,

are remains of machinery belonging to foreign companies to be found at several places in the Nechi district. The expectation had evidently been to find rich placers, but the best ground had already been washed by local miners, who have a shrewd knowledge of this class of work. The Nechi valley is 400 to 500 ft. above the sea, and the climate is tropical. Navigation is possible up to Zaragoza. It is appropriate to note that the Frontino & Bolivia lode mine is situated 25 miles south of Zaragoza.

Fume Ravages.—The fumes from chemical and smelting works are sometimes wrongly accused in connection with damage suffered by farmers. Herbert Porter, inspector for the South Lancashire district under the Alkali Act, mentions in the official report for 1912 that he was called many times to examine damage to vegetation that could not be attributed to the alkali works. Several cases were connected with the failure of the oat crop. Mr. Porter, on investigation, found that the cause was in reality the presence of frit-fly. Some fields were entirely destroyed, and in others the depreciation of the crops was a serious matter to the farmers. The frit-fly lays eggs in the fork of the young plant, between the 'flags' or leaves, and the grub on hatching eats its way downward into the stem, stopping its growth and giving it a much al-

tered appearance. As the root is strong, it sends up additional stalks as substitutes for the stunted ones. If the earlier stalks continue to live, the heads consist of empty husks. The grub soon becomes a chrysalis, and hatches into a fly early enough to provide a second set of eggs and grubs in the same season. Mr. Porter also reports complaints of damage to potatoes and other root-crops, and to hedges. In the former case agriculturists agreed that the real cause was the unusually wet summer of 1912. As regards the damage to hedges, the cause was traced to the continued cold northwest winds occurring just after the chief clipping operations.

Explosions of Flue-Dust.—*Metallurgical and Chemical Engineering* for August refers to explosions and fires that have occurred recently at lead-smelting plants in Utah. These have drawn attention to a contingency that apparently did not exist prior to the use of the latest method of sintering fine ore. At the Tooele smelter of the International Smelting & Refining company an explosion of flue-dust caused serious damage to the roaster flue, and at the Midvale plant of the United States Smelting company a spontaneous fire destroyed a large number of bags. In the case of the flue-dust explosion the usual provision of explosion-doors was insufficient to prevent the wrecking of the flue, and the destruction in the bag-house fire was of much greater magnitude than that caused by incipient fires which sometimes occur in such plants. In each case the trouble is attributed to the presence of finely divided elemental sulphur in the gases from the sinter-roasters. This material, settling in the flue-dust and bag accretions, apparently gives rise to dust explosions when the conditions of temperature and oxidation are favourable, similar to the progressive explosions of other finely divided combustibles, such as coal-dust. That similar explosions have not occurred before is probably due to the fact that in earlier forms of roasters the sulphur was eliminated as some form of oxide instead of a sublimed element, the latter apparently resulting from the present method of roasting. Both the plants mentioned employ the Dwight-Lloyd method of sinter-roasting, a characteristic feature of which is that a comparatively thin layer of ore is quickly agglomerated into a porous mass suitable for smelting. The mixture is exposed to heat for only a short time, and the quantity of air available for oxidation is limited to that which can be drawn through the charge during its passage over the wind-boxes. Under such conditions it is likely that more sulphur would be sublimed, and less oxidized, than in the old forms of hearth roasting-furnaces, or in other forms of agglomerating furnaces. Thus, in the Huntington-Heberlein pot system of sinter-roasting, the charge is deeper, the air-supply more copious, and the progressive sintering slower than in the Dwight-Lloyd method, so there is a greater probability of sulphur being eliminated as oxide. It appears, however, that even with the Dwight-Lloyd system the tendency to distil sulphur into the flue-gases varies with the physical condition of the roaster charge; and the likelihood of resulting explosions also is modified by these conditions. It has been observed that a very wet charge results in the distillation of more sulphur than comes from a reasonably dry mixture. Some moisture is desirable in the mixture, in order to handle it properly, and indeed it is customary to add some water at times; but such excessive moisture as occurs in frozen ore apparently is detrimental. The problem is being investigated, and probably will be well in hand before other disasters can occur. The suggestion has been made that the tendency to distil sulphur might be turned to

advantage by creating conditions most favourable for this action, and recovering the sulphur thus formed. This would have a distinct bearing on the smelter-fume question. At present, means are being adopted to cool the gases in the flues, and to regulate automatically the temperature of the gases entering the bag-house by admitting a variable quantity of air with them.

Cyanide from Sugar Waste.—In the *Columbia School of Mines Quarterly*, C. A. Browne describes the process used in Germany for the production of cyanide from the waste at beet-sugar factories. This residue contains 12 to 15% of potassium and 4% or more of nitrogen. It is first heated in retorts, by which means it is decomposed into a mixture of volatile products consisting of carbon dioxide, carbon monoxide, hydrogen, nitrogen, methane, ammonia, methyl amine, methyl alcohol, water, and other substances. The volatile decomposition products escape from the retorts at a temperature of about 400°C., and are led through a system of tubes heated to a temperature of about 1000°C. The effect of this heating is to convert the volatile nitrogenous compounds into ammonium cyanide, the gas after the treatment containing about 7% NH_3 and 7% HCN . After leaving the hot tubes, the gases, which are always kept under reduced pressure, are cooled, freed from tar, and then washed over sulphuric acid to break up the ammonium cyanide, and the recovery of the ammonium sulphate thus formed. The hydrocyanic acid is then absorbed in water, and the residue of combustible gases is led back to the furnaces for heating the retorts. The hydrocyanic acid is distilled, and absorbed in sodium hydroxide; the solution of the latter, after evaporating and crystallizing, yields sodium cyanide. By the above method, about three-fourths of the nitrogen in the residue is recovered as ammonium sulphate and sodium cyanide, the remaining one-fourth escaping as gaseous nitrogen. A small amount of pyridine is also obtained by this process in connection with the ammonia. The residue of mineral matter in the retorts is worked up for potash, of which some 15,000 tons is made annually in Germany from this source. Two factories in Germany produce annually, by the process of distillation described, about 5000 tons of ammonium sulphate and 5000 tons of sodium cyanide. The sodium cyanide thus manufactured is nearly all exported to the Transvaal.

CURRENT LITERATURE.

Shaft-Sinking and Timbering at Butte.—The August *Bulletin* of the American Institute of Mining Engineers contains papers by N. P. Braley and B. H. Dunshee, on the methods of shaft-sinking and timbering employed at Butte, Montana.

Efficiency of Rock-Drills.—In the *Mining and Scientific Press* for August 2, R. H. Bedford and W. Hague describe Painter's apparatus for testing the efficiency of rock-drills, used at the North Star mine, Grass valley, California.

Concentration at Great Falls.—The August *Bulletin* of the American Institute of Mining Engineers contains a paper by Albert E. Wiggin on the Great Falls system of concentrating copper ores installed at Section I of the Washoe concentrator at Anaconda.

Precipitation of Gold by Manganous Salts.—The *Mining and Scientific Press* for July 26 contains a paper by A. D. Brokaw on the precipitation of gold from solutions by manganous salts.

New Zealand Black Sands.—In the *Australian Mining Standard* for July 3, G. W. Eaton Turner

reviews the previous methods of extracting gold from the black-sand beaches on the west coast of the south island of New Zealand, pointing to a renewal of interest in this class of mining.

Assay of Gold Ores.—The June issue of the *Monthly Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by Robert Dures on the assay of Rand ores, discussing points where inaccuracies may arise, for instance in connection with the varying silver content.

Metallurgical Temperatures.—In *Metallurgical and Chemical Engineering* for August, G. H. Clevenger describes the use of the thermometer in controlling the operations in blast-furnaces, reverberatories, converters, etc. He gives the normal temperatures of various processes with specific charges.

Laist's Leaching Process.—The July *Bulletin* of the American Institute of Mining Engineers contains a description of Frederick Laist's process for roasting and leaching copper tailing as developed at Anaconda.

The Tooele Lead-Smelter.—A paper in the July *Bulletin* of the American Institute of Mining Engineers by H. N. Thomson and L. T. Sicka describes the new lead-smelter at Tooele, Utah.

Great Falls Blast-Furnaces.—The July *Bulletin* of the American Institute of Mining Engineers contains a paper by J. A. Church, giving the history of blast-furnace construction at the Great Falls copper smelter, Montana.

McDougal Roasters.—The July *Bulletin* of the American Institute of Mining Engineers contains a paper by F. R. Corwin and S. S. Rodgers, on the improvements in the McDougal roasting furnace made at the Great Falls copper smelter, Montana.

Great Falls Converter Practice.—The August *Bulletin* of the American Institute of Mining Engineers contains a paper by A. E. Wheeler and M. W. Krecji, describing converter practice at the Great Falls smelter, Montana.

Flue System at Great Falls.—The August *Bulletin* of the American Institute of Mining Engineers contains a paper by C. W. Goodale and J. H. Klepinger, describing the flue and chimney system at the Great Falls smelter, Montana.

Nickel Smelting.—The *Canadian Mining Journal* for August 1 contains a description of the plant of the Canadian Copper company, for sorting, roasting, and smelting the ores of the Creighton, No. 2, and Crean Hill nickel-copper mines, Sudbury, Ontario.

Cost of Copper.—In the *Engineering and Mining Journal* for August 9, Heath Steele analyses in detail the cost of producing copper at the various mines in the United States. The author gave a critical review of extraction at the 'porphyry' mines in the *Mining and Scientific Press* for June 7, which we noted in our *Précis of Technology* for July.

Tungsten in Colorado.—In the *Engineering and Mining Journal* for July 19, Leroy A. Palmer describes the production of ferberite in Boulder county, Colorado, a district which provides 60% of the United States output of tungsten. He reviews the geology, methods of mining, and concentration plants.

Metals in Katanga.—In the *Mining Journal* for August 23 and 30, R. H. Gwyn-Williams describes the tin and other deposits found in Katanga, Central Africa.

Tasmanian Tin.—In the *Mining and Engineering Review* for July, Peter G. Tait gives details of the various tin-mining companies operating in the north-east corner of Tasmania.

Butte Ore Deposits.—The August issue of the *Bulletin* of the American Institute of Mining Engineers, contains an extensive paper by R. H. Sales on the ore deposits at Butte, supplementing the information given in Walter Harvey Weed's monograph on the subject published by the United States Geological Survey.

Scottish Shale Oil.—In the *Engineer* for August 29, A. E. von Groeling commences a series of articles on the distillation of oil from the Scottish shales.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

A Text-Book of Assaying. By C. and J. J. Beringer, revised by J. J. Beringer. Thirteenth Edition. Cloth, octavo, 460 pages, illustrated. London: Charles Griffin & Co. Price 10s. 6d. For sale at the Technical Bookshop of *The Mining Magazine*.

Of books on assaying there is a multitude, but none of them have such perennial vitality as 'Beringer.' For chemical studies in analysis more detailed books are required, and in practice at various mines and smelter special methods are evolved for the particular matter in hand. So that we have many books on assaying and analysis adapted to the occasion. But for the ordinary work of the assayers at mines we all fall back upon 'J. J.' The new edition contains additional matter on the assay of wolfram. Some modifications have been made in the description of the wet assay of tin ores, and the author's article on the subject appearing in *The Mining Magazine* has been incorporated. It is not necessary to review the new edition in detail. Suffice it to say that after an interval of four months, during which time it has been out of print, a great many of our readers will be glad to know that it is once again on sale.

The Cyanide Process of Gold Extraction. Fifth Edition. By James Park. Cloth, octavo, 350 pages, with many illustrations. London: Charles Griffin & Co. Price 8s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

Mr. James Park, professor of mining in the University of Otago, New Zealand, is a most skilful expositor of the science and practice of mining and metallurgy. He has the faculty of presenting his subjects in such logical order that the student can absorb a maximum amount of information with a minimum amount of trouble. The consequence is that his text-books have enjoyed a wide popularity throughout the world. It is only recently that we had some complimentary remarks to make on his 'Mining Geology.' We can safely take a similar attitude toward the new edition of the 'Cyanide Process,' and recommend it to the beginner and to the metallurgist who desires a broad survey of the history of the process and its present applications. So small a book naturally does not give the minutiae of practice sought by the expert, but nevertheless it is wonderful how much detailed information is contained within its pages. The new edition has 350 pages of text, 110 more than the previous edition issued in 1906, and the increase in the number of illustrations is in the same ratio. The advance in slime-treatment accounts for a large part of the additional matter. The author has included descriptions of typical modern installations of plant in various parts of the world, drawn from the best sources. The

chapter on analysis of cyanide solutions has been extended. It is of interest to remind readers that Mr. Park experimented with the air-agitation of slime years before F. C. Brown erected what is now called the Pachuca at Komata Reefs, in New Zealand, and with vacuum-filtration long before the Moore, Butters, and Oliver filters were known, so that he watches the development of these methods and processes with a paternal eye.

Iron Mining in Minnesota. By Charles E. Van Barneveld. Cloth, octavo, 220 pages, with many maps and illustrations. Minneapolis, U.S.A.: The University of Minnesota.

This book constitutes Bulletin No. 1 issued by the Minnesota School of Mines Experiment Station, inaugurated by the University of Minnesota. It is written by Mr. Van Barneveld, who has recently been appointed head of the mining section at the forthcoming Panama Exposition at San Francisco. The Minnesota iron mines have for nearly twenty years supplied the major portion of the iron-ore supply of the United States, and the mining practice, both open-cut and below-ground, has provided many points of interest to the engineer. This volume gives full details of the mining practice, and wherever possible the cost of operation. The information relating to work by steam-shovel, and the accounts of the methods of shaft-sinking and mining in treacherous ground are of special interest.

Brazil in 1912. By J. C. Oakenfull. Cloth, octavo, 500 pages, with maps and illustrations. London: Robert Atkinson, Ltd. Price 5s.

Brazil has progressed rapidly during the last 15 years, and with the greater political and social stability has come a vast increase in the development of its resources, especially in its southern portion. Mr. Oakenfull gives detailed information relating to manners and customs, government, trade conditions, opportunities for business, etc., and his book is a useful guide to all visitors. As regards minerals, the iron deposits of Minas Geraes promise within a few years to provide a large share of the world's output. The author is inclined to encourage the attention of gold-dredging experts. We hoped to find some mention of the reported rich gold deposits of Counani, the disputed territory between the Amazon and the Guianas. In a future edition we hope the author will give some information about the region.

Nigerian Mining Manual. By Albert F. Calvert. Cloth, small octavo, 430 pages, with maps and plans. London: Effingham Wilson. Price 4s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This book gives details of the mining companies operating in Nigeria, and of the laws and regulations governing the industry.

Oil Fuel. By Vivian B. Lewes. Small octavo, 260 pages. London & Glasgow: Collins' Clear-Type Press. Price 1s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This little volume has been written specially for Collins' series called 'The Nation's Library.' It is not intended as a rival to Redwood's 'Petroleum,' Beeby Thompson's 'Oil Mining,' or Cunningham Craig's 'Oil Finding.' It is meant rather to be a help to the ordinary man of intelligence interested in shares in oil companies, or in power problems. The author discusses the origin and occurrence of petroleum, and describes the oilfields of the world, the methods of

winning by wells, and of refining the products. A chapter is devoted to the transportation, storage, and physical properties of oil, and one to shale-oils and other liquid fuels. The remainder of the book describes the various applications of oil for power purposes, gas-production, lubrication, etc. The section devoted to the production of light oils, suitable as substitutes for petrol, by the decomposition of heavy oils, is particularly interesting. Mr. Lewes is not an enthusiast with regard to the future supplies of petroleum, and from the point of view of the English navy and other users of oil in this country, his views of the available resources are decidedly depressing. As he says in his preface, he does not expect this book to be popular among boomers of oil properties; but as he genuinely believes in his conclusions, his opinions should be studied and treated with respect.

Pocket Glossary of Technical Terms, English-German and German-English. By Joseph G. Horner and Otto Holtzmann. London: Crosby Lockwood & Son. Price 3s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This little book consists of a glossary of English and German terms used by engineers and manufacturers, more especially in connection with the mechanical engineer's workshop. Neither Mr. Horner nor Mr. Holtzmann is new to dictionary-making, and they are both experienced engineers.

The Cornish Coast and Moors. By A. G. Folliott-Stokes. Cloth, octavo, 390 pages, with many photographic illustrations. London: Greening & Co. Price 5s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

It is a congenial holiday task to follow the author on his breezy tour of the Cornish coast. He takes us from Bude to Tintagel, Newquay, and St. Ives, thence to Land's End and Penzance, to the Lizard and Falmouth, to Fowey, Looe, and Plymouth, the journey being made along the old tracks of the coastguardmen. Far from the railways and motor roads, we enjoy to the full the cliff scenery. We follow with wrapt attention the author's observations of wild flowers, birds, and animals, which thrive generously beyond the usual haunts of the tourist and visitor, and we enjoy his interludes of legendary lore. Not the least valuable feature of the book is the magnificent series of photographic views. In some ways the book may be considered a companion volume to Newell Arber's 'Coast Scenery of North Devon' which we reviewed in these pages a year ago. It is not however so strictly technical in a geological sense. But the two books are of equal charm to the lover of the native glories of the West Country. Mr. Stokes' volume is a book of travel, and, written in a romantic mood, constitutes a pleasing contrast to the usual guide. He tells us of difficultly accessible silver-thread gorges, and omits reference to the jubilee clock-tower adorning the promenade and presented by the local mayor. He is more in love with the indigenous centaury, sundew, and bell-flower, than with the exotics of Morrab and Penjerrick, the latter imported to give a fictitious reputation to the Cornish winter. As a describer of scenery, Mr. Stokes is undoubtedly at his best when telling us of the cliffs north of Bude near the Devonshire border, and of the coast between St. Ives, Land's End, and Treryn. At the far north of Cornwall are found excellent types of contorted strata, and waterfalls leaping from the cliffs to the beach. The jointed granite of the western Penwith coast provides many a scene reminiscent of a giant's enchanted castle, one headland after another vying in grotesque grandeur.

These two parts of the county are the least known to the average visitor, who may visit Land's End and Cape Cornwall, but seldom sees Gurnard's head, Rosemergy, or Pordenack. Mr. Stokes occasionally takes us inland to the moors to give us the tonic of lighter air, and so to counteract the effects of the salt-laden atmosphere of the coast. A day on Bodmin moor, on the downs between Newquay and Lost-

each place is not fully understood until a journey is made in both directions. For instance, if Mr. Stokes had taken us from Falmouth along the east shore of Swanpool to the sea, we should have appreciated this pretty spot more adequately. We should have ascertained at the beginning of the walk whence the little lake obtained its name, and as we walked we should wonder where to find the outlet to the bay through the



JOINTED GRANITE AT PORDENACK, CORNWALL.

withiel, or at Goonhilly, is appreciated by all whose avocations tie them to the coastal towns. The plan of seeing the cliffs from the top, as advocated by Mr. Stokes, is not always properly appreciated by the sight-seer. Many are content with walking along the beach, if this be possible, or of sailing within safe distance. Nine cases out of ten the view and effect obtained by descent of a gorge is superior to that gained by progress upward. The scene is more expansive and the outlines of the hill or cliff are more impressive. Another thought in connection with touring is that

wooded slopes on each side. On arriving at the bank of shingle separating the fresh from the salt water we should admire the small spherical pebbles of the beach. For this reason a description by Mr. Stokes of a return journey, starting from Plymouth and ending at Bude, would be welcome. As a final word let us recommend our readers to visit Cornwall in a mood like Mr. Stokes', and we would add: go in spring, summer, or autumn, and not in the winter, in spite of the seductive invitations issued by the Great Western Railway. E. W.

COMPANY REPORTS

Burma Mines.—This company was formed in 1906 by Bewick, Moreing & Co., for the purpose of acquiring ancient silver-lead mines and slag-heaps at Bawdwin, near Lashio, Upper Burma, not far from the Chinese border. The oxidized ores had been worked by open-cut by the Chinese miners for the silver content, and the accumulated slag left by them contains as much as 45% lead. The company commenced development by sinking, and found that the sulphide zone below contained much zinc. The results obtained at the mine and smelter were not as satisfactory as expected, and three years ago the company was reconstructed, the shares being reduced from £1 to 4s., with a liability of 2s. each. The report for the year 1912, now issued, shows that further capital is required. The capital as at December 31 last was 25,538 shares of 4s. each fully paid, and 286,508 similar shares 2s. paid; and there were £213,685 debentures. It is now proposed to provide £100,000 additional cash, secured as to £35,000 by a lien on the receipts from the sales of lead, and as to £65,000 by the issue of £45,000 debentures and 100,000 shares. During the year 1912, 1666 tons of development ore and 3550 tons of ore mined chiefly from open-cut was raised; 3907 tons was sent to the smelter and 369 tons shipped to Europe. In addition, 12,566 tons of old slag was recovered by sluicing. At the smelter 25,513 tons of ore and slag was treated, the charge also including 5931 tons of coke, 8510 tons of iron ore, 6894 tons of limestone, and 313 tons of scrap iron. The yield was 8564 tons of bullion. The smelter has been moved from Mandalay to Nam Tu, near the mine, a sintering plant has been provided for the agglomeration of the fineslag recovered by sluicing, and a refinery has been added. The developments at the mine are promising, and large amounts of ore, averaging 25 oz. silver, 25 to 30% lead, and 22 to 26% zinc, have been proved. Lodes containing chalcopryrite in addition to blende and galena have also been discovered. A geological examination has been made by J. Malcolm Maclaren, whose views will constitute a guide for the future developments. The sale of bullion, etc., during the year brought an income of £156,726, and the loss on the year's working was £14,911.

Robinson Deep.—This company belongs to the Consolidated Gold Fields group, and owns a property, constituting a 'second deep,' in the central part of the Rand, being on the dip of the Robinson Central Deep (now absorbed in the Crown Mines) and the Ferreira Deep. Milling commenced in 1898 with 40 stamps, and subsequently 260 stamps and 5 tube-mills were added. During 1912, however, the metallurgical plant was re-arranged, 140 stamps being discarded and 8 tube-mills added. This had the effect of raising the monthly capacity from 50,000 to 60,000 tons. The report for the year ended March 31 last, shows that the increase in the monthly tonnage did not actually begin until December owing to scarcity of labour. During the last four months of the financial year, the average monthly tonnage was 57,100 as compared with 49,425 during the first eight months. The total ore raised from the mine was 696,524 tons, and after the removal of 10% waste, 623,800 tons was sent to the mill. The yield by amalgamation and cyaniding was 219,009 oz., worth £919,131, being a recovery of 7 dwt. or 2½s. 5d. per ton. The working cost was £554,744, or 17s. 9d. per ton, leaving a profit of £365,588, or 11s. 8d. per ton. Out of the profit, £34,808 was paid as taxes, and £60,000 to the govern-

ment on account of undermining rights, while the shareholders received £275,000, the dividend being at the rate of 27½%. The reports of C. D. Leslie, superintending engineer, and J. J. Wessels, manager, show that there was a decrease in the recovery of 2s. 4d. per ton and an increase in the working cost of 2d. per ton, with the result that the dividends were £50,000 less. The ore reserve is now quoted in tons to be mined, not in 'milling tons,' and a re-estimate on March 31 gave the reserve at 1,538,000 tons, averaging 6 dwt. per ton, together with 346,000 tons of partly developed ore averaging 5'88 dwt. per ton. Sand-filling was commenced in February, and in the course of a short time it is expected that the whole of the current sand will be sent underground. In this mine, stope-drills are largely employed, and during the past year 73% of the ore hoisted was mined in this way.

Dolcoath Mine.—The report of the premier tin mine of Cornwall for the first half of 1913 shows a yield per ton lower than ever before recorded. The extraction per ton was 30 23 lb. black tin, as compared with 32'09 lb. during the previous half-year, and 79'19 lb. during the first half-year of the present company's existence, July to December 1895. The amount of ore raised was 58,304 tons, a fall of 2327 tons as compared with the previous half-year, the smaller amount being due to a suspension of hoisting while altering the winding-engine. The yield of black tin was 787 tons, as compared with 868 tons during the previous half-year. The amount realized was £105,964 as compared with £119,487, and the price received per ton was £134. 13s. as compared with £137. 10s. 11d. Other items brought the total income to £106,982; the working cost was £67,856, and lord's royalties £7064, leaving a net profit of £32,061. The working cost was £3910 higher, or 2s. per ton, due chiefly to the extra amount of underground development and prospecting. Out of the net profit, £4919 was written off for depreciation of plant, etc., leaving a balance of £27,142. Out of this, £17,500 has been distributed as dividend, being at the rate of 5% for the six months. At the meeting of shareholders, R. Arthur Thomas, the manager, gave details of the development done during the half-year. A cross-cut had been driven at 1260 ft. to intersect the north series of what are called the Entral lodes. They had struck the South Entral lode and driven on it east and west, the average content disclosed being from 35 to 40 lb. black tin per ton. Two other cross-cuts are in hand, at the 1140-ft. and 1380-ft. levels. This lode was worked in the early days for copper in the slate, down to the 420-ft. level. The development at the deep levels round Williams' shaft has also given better results just recently than for some time past.

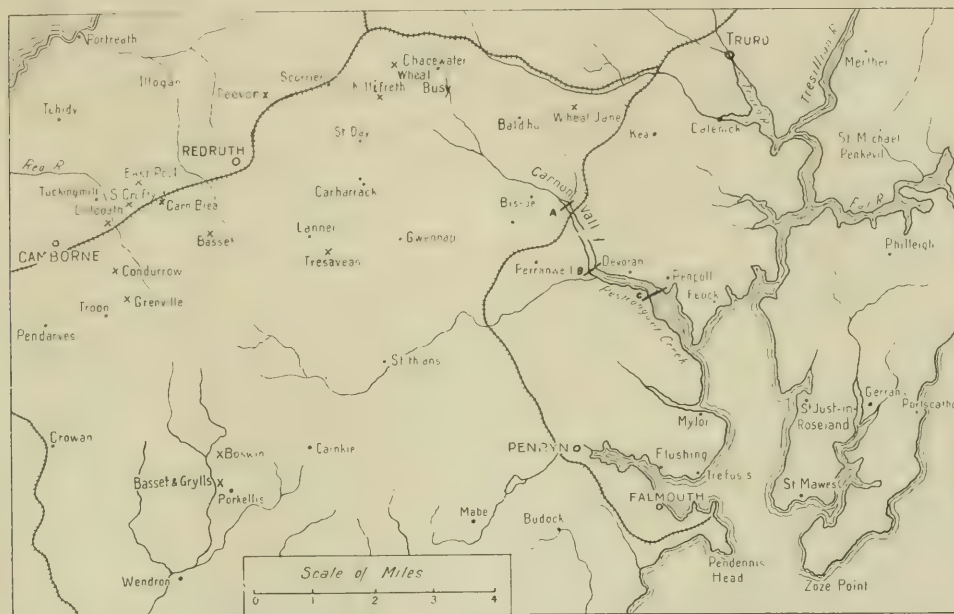
Grenville United Mines.—This company was formed in 1906 under limited liability, to acquire the Grenville mines situated to the south of Camborne, which had previously been worked under the cost-book system. Much active development has been done by the manager, Henry Battens, and substantial dividends have been paid. The report for the half-year ended June 30 shows that the yield per ton has been slightly lower as compared with the previous half-year, but the developments have been highly promising and the yield is expected to be higher during the current period. During the half-year 22,227 tons was raised, from which an average of 36'87 lb. of concentrate per ton was recovered. The sales totalled 349 tons, realizing £48,033. During the previous half-year, the yield per ton was 39 lb. and the sales 368 tons. The profit was £17,992, out of which £3547 was paid as

royalty, and £13,117 distributed as dividend, being at the rate of 15%. The mine continues to be troubled with heavy inflows of water, and all the pumps were working continuously during the winter. The rock in which development has recently been done is exceptionally hard, curtailing the amount of work possible. The results of development in the ground between the 355-ft. and 375-ft. levels have been most gratifying in both directions. In one case the ore is calculated to yield 50 lb. concentrate per ton, and at another part the vein is 18 in. wide, assaying 110 lb. per ton.

Carnon Valley (Cornwall).—The statutory meeting of shareholders in this company, recently formed, was held on August 11. The object of the company is to work the tin sand in the Carnon valley and Restronguet creek, one of the tributaries of Falmouth harbour.

Tailings Co., which is re-working the Carn Brea & Tincroft dumps. In the accompanying map, the property of the company is indicated by the letters A, B, C. The part A to B, above high tide, is the section under present consideration, and the part B to C is below high tide.

Carn Brea & Tincroft.—The report of this company, working tin mines near Camborne, for the first half of 1913 is a decidedly depressing document. It shows a loss on working and gives no immediate hope of improved results from developments. Our readers will remember that the company was registered under limited liability in 1900, to acquire property that had been worked for tin since 1832 on the cost-book system. Two years ago, Edward S. King was appointed manager, in the hope that an engineer of proved abil-



MAP OF PART OF CORNWALL, SHOWING GROUND TO BE WORKED BY CARNON VALLEY COMPANY.

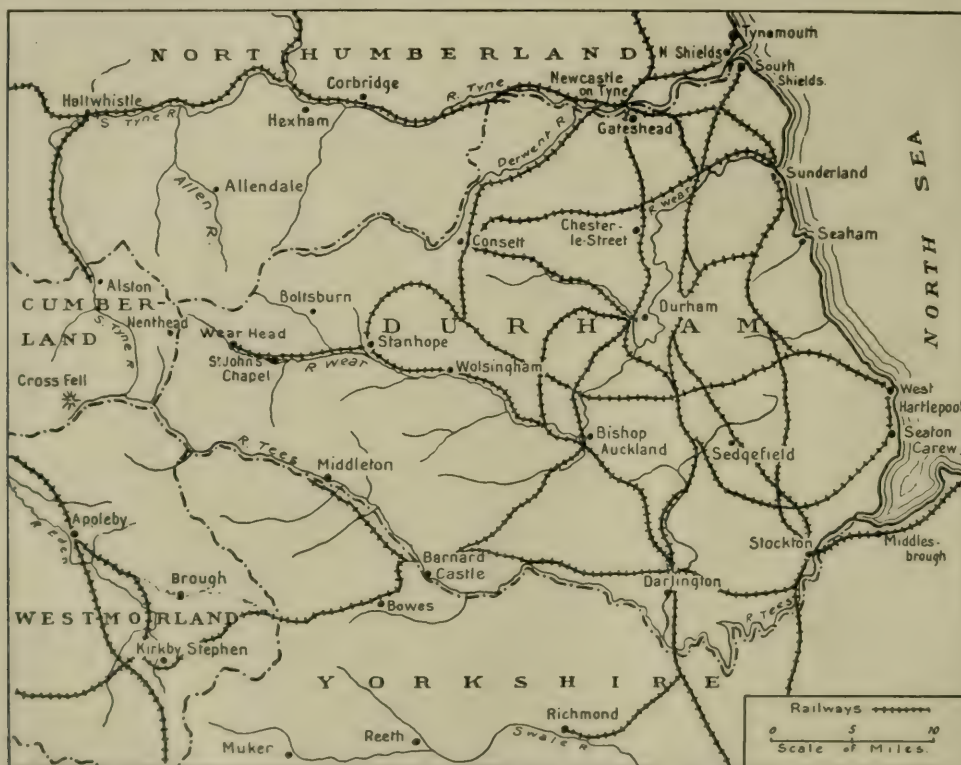
Plans have been made for machinery to treat 400 tons per day. The sand is to be pumped on the Australian system to the works, where it will be re-ground and concentrated. The cost of the plant is estimated at £25,700. Investigations show that above high tide 1,900,000 tons, averaging 12½ lb. tin per ton, is available. The cost is figured at 3s. per ton, and a 50% recovery is anticipated. Much tin-bearing sand has also been proved below the level of high tide; as its beneficiation involves some engineering difficulties, consideration of this ground is being postponed for the time. The capital of the company is £175,000 in £1 shares; of these, 71,250 shares have been allotted fully paid to the promoters for services rendered in subscribing and procuring subscriptions for shares and debentures; 66,250 shares have been subscribed in cash and 3s. each has been paid up. Debentures for £20,000 carrying 7½% interest have been created in satisfaction of cash paid on the company's behalf in respect of the property acquired. The directors are T. J. Hoover, W. L. Baillieu, W. S. Robinson, J. T. Lempiere, and H. J. Hill. Ross Macartney is manager. The company is closely allied to the Cornwall

ity in newer countries might bring success to an old mine in Cornwall. Mr. King pointed out many errors in methods of hoisting, pumping, and concentration, and he was able to effect economies, and to provide a dividend of 5% on the £50,000 priority shares on the results of work during the half-year ended June 30, 1912. At the time, it was noted that the high price of tin was the chief factor in providing this profit. Since then, the results of development work have been discouraging, and the average recovery per ton of ore mined has been the lowest on record. The report for the six months ended June 30 shows that 45,537 tons of ore was raised, as compared with 48,055 tons during the previous half-year, and that the amount of concentrate obtained was 361 tons, as compared with 455 tons. The yield of concentrate per ton was 19 lb. as compared with 21½ lb. The receipts from the sale of concentrate were £48,009, as compared with £57,078, and the price received per ton of concentrate was £123. 16s. 3d., as compared with £125. 6s. 9d. The sale of arsenic and wolfram brought the total receipts to £51,650. The working cost was £52,578, an increase of £1584, the lords' royalties were £1857, and

the net loss was £2785. The working cost per ton was 23s. 1d., an increase of 1s. 10d. Some months ago we announced that one of the lords, Viscount Clifden, was prepared to advance capital at a low interest, for the purpose of equipping the mines with improved concentration plant. Modifications have since been made in the terms. At the meeting of shareholders, Mr. King reported that at several points the discoveries were encouraging and stated that development ought to be prosecuted on an extended scale.

Weardale Lead.—This company has been working a group of lead mines in Durham, in the north of England, since 1883. The mines are in the high country of the Pennine chain, near the boundaries of Northumberland and Cumberland, and are not far from the lead-zinc mines of Alston and Nenthead. The galena

De Lamar.—This company was formed in 1891 to acquire from Henry Bratnaber the gold-silver mine previously worked by J. R. De Lamar in Owyhee county, Idaho. For five years the mine did well and returned 107½% on the capital of £400,000. Afterwards the profits fell and the subsequent 17 years have yielded only 41% additional. In 1901 the capital was reduced to £80,000, and the dividends have been intermittent. The report for the year ended March 31 last shows that 43,618 dry tons was raised and treated, yielding 10,866 oz. gold and 169,793 oz. silver. The income from the sale of bullion was £68,026, and interest, etc., brought the total receipts to £69,506. The cost at the mine was £55,944, and in London £1894, to which is added £191 income tax. The net profit for the year was £1477, to which must



THE LEAD MINING DISTRICT OF THE NORTH OF ENGLAND.

is found as a replacement in carboniferous limestone. Henry Louis is technical advisor and H. S. Willis is manager. The report for the year ended June 30 is a cheerful one. During the year, 4841 tons of concentrate was smelted, yielding 3547 tons of lead, which sold for £64,342, or £17. 18s. 8d. per ton. Sales of fluor-spar brought an income of £8215. The profit was £22,849, out of which £12,239 has been distributed as dividend, being at the rate of 12½%. The sum of £8807 has been written off property account, and £1336 has been allowed for depreciation of investments. Most of the lead ore is obtained from the Boltsburn mine, and the Stanhopeburn and Sedling mines produced 9042 tons and 5302 tons of fluor-spar respectively during the year. The chairman, at the meeting of shareholders, announced an important discovery of ore at the Boltsburn mine.

be added £2941 brought forward from the previous year, making a disposable balance of £4418. Out of this, £4000 has been distributed as dividend, being at the rate of 5%. Ernest V. Orford, the manager, reports that the ore extracted has been of disappointingly low grade as compared with the previous year, when 43,629 dry tons yielded 14,656 oz. gold and 279,723 oz. silver, selling for £91,811. The cost at the mine was less this year than last, the figure a year ago being £91,132, and no dividend being paid. The dumps still provide small amounts of material worth treating, 1602 tons, averaging \$2.56 per ton, having been sent to the mill during the year under review, in addition to the ore from the mine. It is not expected that much of the remaining dump-material will be worth consideration. In October last, F. F. Sharpless made another examination of the property and re-

commended prospecting and development at several points, together with the adoption of electric-air drills for this purpose. As customary, Mr. Orford is not able to indicate with any certainty the future of the property, as there are no reserves. During the past year £13,585 has spent out of capital on exploration and development, leaving £25,394 capital still unexpended.

Mungana.—This company was formed in Melbourne in 1901 to acquire the Girofla and Lady Jane mines from the Chillagoe company, which still holds a large interest in the share capital. The ore consists of mixed argentiferous lead and copper sulphides, with some oxides and carbonates, occurring in bunches in limestone. The mines are in north Queensland, 100 miles west by railway from Mareeba. In April 1912, the company was reconstructed in order to raise

£15,183, but the cost of mining and maintenance exceeded this by £4602. The ore reserve is estimated at 48,213 tons in the Lady Jane and 54,350 tons in the Girofla. Prospecting at the Tartana has disclosed copper-lead ore of good quality, but the deposits are small and not continuous.

Etheridge Gold Mines.—This company was formed in Melbourne in December 1910, to acquire from the Chillagoe company four gold mining properties known as the Big Reef, Havelock, Nil Desperandum, and Queenslander, at Forsyth, in the Etheridge goldfield, North Queensland. The Havelock mine contains gold-copper ore, and the Queenslander lead-zinc ore containing gold and silver. The report for the year ended January 31 last shows that the concentrator and the cyanide plant have been erected and should be at work by now. The ore is crushed and concentrated on



additional working capital. There are 500,000 shares of 6s. each, of which 5s. was credited as paid and 1s. called up in cash. The report for the year ended March 31 last shows that the fire at Lady Jane still gave trouble, after four years' attempt to extinguish it. No less than £10,694 has been spent in attempts to confine it and to swamp the mine locally. These efforts having failed, it has been decided to let the mine fill with water. This will take some time, as the rate of rising is only 5 ft. per week. During the early part of the financial year, mining was not actively pressed at the Girofla mine, because the terms of contract for the sale of the ore to the Chillagoe smelter were not favourable. Afterward the contract was modified and more ore was raised. The production during the year was 12,736 tons, averaging 1% copper, 13% lead, and 7 oz. silver. In addition, 103 tons was extracted from the Lady Jane and 8 tons from the Tartana. The amount received from the sale of ore was

Wilfley tables and in Minerals Separation flotation plant, and the tailing is slimed in tube-mills and cyanided. The ore reserve at the various mines is estimated as follows: Big Reef, 8350 tons averaging 16 dwt. gold per ton; Havelock, 16,060 tons averaging 15 dwt.; Nil Desperandum, 9240 tons averaging 14 dwt.; and Queenslander, 16,700 tons averaging 16 dwt.; total 50,350 tons, averaging 15 dwt. per ton. The development work at depth is giving satisfactory results at the Havelock and Nil Desperandum. No work has been done recently on the Queenslander and Big Reef. The capital of the company is £60,000, of which £50,000 was subscribed in cash by shareholders in the Chillagoe company. The sum of £20,409 has been spent on the equipment of the concentrator and cyanide plant, and £6741 on development at the Havelock and Nil Desperandum.

Mount Morgan Gold.—The report of this gold-copper company, of North Queensland, for the year

ended May 31 last, is the first issued since the change of control. During the year, 322,098 tons of ore from the mine, Many Peaks pyrite ore, and miscellaneous material was treated, yielding 9280 tons of copper and 118,487 oz. gold. In addition, 7594 oz. gold was recovered from the dismantled chlorination plant. The total revenue was £1,140,028, and the expenditure £738,898. The dividends absorbed £200,000, being at the rate of 20%, and £100,000 was placed to the fund for re-building the metallurgical plant, while £69,412 has been written off for depreciation and replacement of stores. Owing to some of the existing plant proving unreliable, a larger amount of money will be required in re-building than was originally calculated. It has also been decided to start concentrating the low-grade silicious ore, and £56,000 will be spent on plant for this purpose. The ore reserve on May 31 was estimated at 1,365,000 tons of high-grade ore and 1,982,000 tons of medium grade. Figures are not given for the reserve of low-grade ore, but it is stated that there is sufficient to increase the life of the mine by many years.

Anchor Tin Mine.—This company was formed in 1895 to acquire a lode-tin property at Lottah, in the northeast of Tasmania. The ore is probably lower in grade than any worked elsewhere, the average yield being between 3 and 4 lb. black tin per ton. No profits have ever been made, and it has been necessary to re-construct in 1902 and 1909. There are 100 stamps, but all are not at work. The company also operates the Australian mine belonging to the Blue Tier Tin company under a profit-sharing arrangement. C. Williamson Milne is chairman, James B. Lewis is manager, and Bedford McNeill is consulting engineer. The report for the year ended March 31 last shows that the output was less than usual owing to an accident to the rock-crusher. The amount of ore from the two mines treated was 86,240 tons, as compared with 104,732 tons the year before. The average number of stamps at work was 52. The yield of black tin was 140.6 tons, as compared with 188.3 tons, and the recovery per ton was 3.63 lb., as compared with 4.02 lb. The cost of mining and milling was 4s. 1d. per ton, as compared with 3s. 6d. About two-thirds of the ore treated came from the Anchor mine and the remaining one-third from the Australian mine. The accounts show a net profit of £56, which was carried forward. The capital of the company is 100,539 ordinary shares of 5s. each and 6540 preference shares of £1 each. There are £25,000 debentures carrying interest at 4%, and there is a loan from the Tasmanian Government of £5000 at 4½%, besides a bank loan and overdraft of £8253. The loan from the Tasmanian Government was obtained for the purpose of building an aerial ropeway to the Australian mine. We do not see from the revenue account that interest is being paid on the debentures.

Willoughby's Consolidated.—This company was formed in 1894 to consolidate various land and mining interests in Southern Rhodesia, owned by Sir John Willoughby and others. The only cash dividend was 5%, paid in 1910. The present capital stands at £700,314, divided into 1,400,628 shares of 10s. each, and there are £203,900 debentures. The report for 1912 shows an income of £72,259, of which £32,663 came from the sale of gold produced at the Eiffel Blue mine, £5460 from royalties on gold won by tributors, £26,454 from rents and sales of land, etc., and £4712 from interest and dividends. The balance of profit was £8692, which was carried forward. The company operates the Eiffel Blue mine in the Hartley district, where during 1912, 15,670 tons of ore was treated for

a yield of 7736 oz. gold. The development has been satisfactory, and the mine though small is profitable. The following mines are let on tribute: Blanket, Alice-Atlas, West Queen's, Bonsor, North Bonsor, Broad Arrow, Sheba-Bongola, Great Tontine, and Mammoth. The total ore raised at these mines was 49,055 tons and the yield 12,594 oz. The company owns large share interests in the Matabele Queen's, Eileen Alannah, and Connemara companies. At the Matabele Queen's, 16,517 tons of ore was treated for a yield of gold worth £37,913; development has been highly satisfactory. At the Eileen Alannah, 250,726 tons has been proved, averaging 52s. 5d. per ton, and a plant has been ordered to treat 5000 tons per month. At the Connemara, development work is being done with encouraging results. Already 179,394 tons containing gold worth £279,540 has been proved, and a plant similar to that for the Eileen Alannah is recommended. The lodes at the Connemara are wide, and it is expected that the cost of operation will not be more than 15s. per ton. Schemes are in hand for extensively developing the company's agricultural land; this work will be done in conjunction with the British South Africa company.

Geri River Tin Mines.—This company was formed in March 1912 by the Doolette group, to acquire alluvial tin properties on the Geri river, in the Bauchi district of Northern Nigeria. These properties however did not prove satisfactory, and were abandoned. Since then, the Helston Moor and Unity groups of properties in Cornwall have been acquired, after an exhaustive examination had been made by C. H. Wray. These properties are situated within ten miles of each other, the Helston Moor being between Helston and Wendron and the Unity at Gwinear, four miles from Hayle. The Helston Moor deposit consists of tin-bearing alluvium accumulated from milling operations conducted in earlier days along the upper banks of the Cober river. Borings have so far proved the existence of 80,000 tons of alluvium containing 8 lb. of extractable black tin per ton, and beyond the five acres thus prospected there is a probable further amount of material amounting to 40,000 tons, of similar content. The treatment plant is to cost £1500, and will have a capacity of 50 tons per day. The cost, including every item of company expenditure, is estimated at 5s. per ton, and the receipts per ton are figured at 8s. The Cober river rises in the high ground south of Camborne and Redruth and flows south past Wendron and Helston into Looe Pool, between Porthleven and Poldhu. It has been the receptacle of tailing from many mining operations. Mr. Wray has conducted many trial borings. He occasionally found fragments of ore rich in cassiterite, and he is of opinion that below the more recently accumulated alluvium will be found some ancient stream tin. This property has been purchased from the Wendron Cornwall Tin Mines, Ltd., for whom J. S. Allen, of Helston, had done much development work. The Unity property at Gwinear is a different proposition. It consists of alluvial flats, waste dumps, and accumulations of sand and slime. The dumps and flats are estimated to contain 35,000 tons, calculated to yield 10 lb. black tin per ton, and of the waste 5000 tons are expected to yield a similar amount per ton. In the mine itself, 10,000 tons of old pillars, etc., are worth extracting, and are reported as containing 10 lb. recoverable black tin. Several of the lodes in the Unity group are worthy of development at depth. Mr. Wray draws attention to the fact that the margin of profit at these two properties will be small, and that due care will be requisite in their economical management.

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Scientia non habet inimicum nisi ignorantem.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	July 31 Tons	Aug. 31 Tons	Sept. 30 Tons
In England.....	18,037	16,829	15,134
In France.....	3,132	3,177	2,715
Afloat from Chile.....	2,175	2,300	1,225
Afloat from Australia.....	5,000	4,200	3,450
In Rotterdam.....	4,000	3,600	2,700
In Hamburg.....	1,584	2,138	1,121
In Bremen.....	1,699	1,801	1,475
In other European Ports.....	1,200	900	1,100
Total European visible supply.....	36,827	34,945	28,919

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Production.	Deliveries			Stocks at end of month
		Domestic	Foreign	Total	
Total, 1911.....	639,258	316,791	337,009	653,800	—
Total, 1912.....	706,052	365,920	333,212	699,132	—
January.....	64,053	29,111	26,956	56,067	55,000
February.....	58,460	26,641	32,219	58,860	54,600
March.....	60,822	34,190	34,682	68,872	46,550
April.....	60,416	34,892	38,346	73,238	33,728
May.....	63,088	36,209	30,477	66,686	30,130
June.....	54,402	30,559	30,396	60,955	23,577
July.....	61,640	26,296	35,035	61,331	23,886
August.....	58,764	32,897	32,706	65,603	17,064
September.....	58,661	29,837	32,627	62,464	13,261

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand		Else-where	Total	Value
	Oz.	Oz.	Oz.	Oz.	£
Year 1912.....	8,753,563	370,731		9,124,299	38,757,560
January 1913.....	760,981	28,409		789,390	3,353,116
February.....	702,394	31,728		734,122	3,118,352
March.....	760,324	30,228		790,552	3,358,050
April.....	755,858	29,116		784,974	3,334,358
May.....	761,349	32,957		794,306	3,373,998
June.....	716,267	30,810		747,077	3,173,382
July.....	625,107	30,282		655,389	2,783,917
August.....	697,686	30,410		728,096	3,092,754
September.....	676,411	29,775		706,186	2,999,686

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
Year 1912.....	25,486,361	29 2	19 3	9 11	12,678,095
January 1913.....	2,296,948	27 8	18 0	9 9	1,113,579
February.....	2,100,137	27 11	18 3	9 9	1,019,774
March.....	2,321,254	27 5	17 8	9 8	1,121,786
April.....	2,301,099	27 6	17 11	9 7	1,101,099
May.....	2,366,726	26 11	17 7	9 4	1,099,397
June.....	2,177,354	27 6	17 8	9 9	1,061,507
July.....	1,873,980	27 6	19 4	8 3	785,263
August.....	1,142,807	27 1	17 7	9 6	1,026,851

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
January 31, 1913.....	200,090	8,789	13,912	222,791
February 28,	207,662	8,877	13,918	230,457
March 31.....	207,233	9,009	15,041	231,783
April 30.....	205,424	9,053	15,426	230,103
May 31.....	197,644	9,062	15,345	222,051
June 30.....	196,004	9,060	14,224	219,288
July 31.....	170,242	9,405	13,378	193,023
August 31.....	158,223	9,236	13,172	180,631
September 30.....	152,637	9,361	12,321	174,319

GOLD OUTPUT OF INDIA.

Year 1911	Year 1912	Sept. 1913	Year 1913
£2,150,050	£2,265,094	£1,014,642	£1,710,464

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1909	1910	1912	1913
	£	£	£	£
January.....	204,666	227,511	214,918	220,776
February.....	192,497	203,888	209,744	208,744
March.....	202,157	228,385	215,102	257,797
April.....	222,700	228,213	221,476	241,098
May.....	225,032	224,888	234,407	242,452
June.....	217,600	214,709	226,867	241,302
July.....	225,234	195,233	240,514	249,302
August.....	228,296	191,423	239,077	250,576
September.....	213,249	178,950	230,573	—
October.....	222,653	234,928	230,072	—
November.....	236,307	240,573	225,957	—
December.....	233,397	199,500	218,661	—
Totals.....	2,623,788	2,568,201	2,707,368	1,912,048

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January.....	15,903	66,107	26,098	107,262	34,857	144,262
February.....	15,179	63,081	25,009	102,270	32,544	137,038
March.....	16,387	67,673	27,228	111,376	36,289	150,606
April.....	17,237	70,880	27,790	114,796	35,295	146,220
May.....	24,427	96,409	28,015	115,676	34,507	142,617
June.....	22,555	92,174	27,784	114,697	30,503	125,764
July.....	22,510	91,955	30,974	127,800	32,345	132,936
August.....	25,385	103,753	33,015	136,407	30,247	126,090
September.....	26,717	109,039	34,491	142,397	—	—
October.....	26,827	109,053	34,436	142,414	—	—
November.....	24,289	99,299	33,183	137,700	—	—
December.....	24,369	99,569	34,917	144,382	—	—
Totals.....	261,784	1,069,442	362,940	1,497,179	266,587	1,104,987

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910.....	363,496	1,209,856	1,573,352	6,682,042
Total, 1911.....	160,021	1,210,447	1,370,468	5,823,522
Total, 1912.....	83,589	1,199,080	1,282,669	5,449,057
January 1913.....	9,738	94,967	104,705	444,756
February.....	8,780	92,207	100,987	428,963
March.....	754	97,015	97,769	415,294
April.....	7,920	103,324	111,244	472,532
May.....	7,094	103,085	110,179	468,007
June.....	5,112	108,373	113,485	482,050
July.....	11,705	97,091	108,796	462,133
August.....	7,611	102,558	110,169	468,070
September.....	3,206	112,062	115,268	489,872

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	Sept. 1913	1913 to date
		£	£	
Victoria.....	2,138,000	2,039,400	160,300	1,386,900
Queensland.....	1,623,390	1,484,160	94,350	851,430
New South Wales.....	769,353	702,129	44,928	455,155
New Zealand.....	1,808,049	1,345,115	146,437	1,129,396

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911.....	6151½	£702,599	£114 4 5
Year 1912.....	6492	£831,908	£128 5 6
January to August, 1913.....	4041½	£519,011	£128 8 3
September 1.....	224½	£25,493	£113 8 3
September 15.....	251½	£27,837	£110 13 8
September 29.....	235	£25,602	£108 19 0

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1912 tons	Sept. 1913 tons	1913 tons
Metal from Straits to Europe and America.....	59,036	5,160	46,713
Metallic Content from Bolivia to Europe.....	21,149	2,383	18,956

REVIEW OF MINING

INTRODUCTORY. — The continued apathy, akin to depression, in the City is becoming intensely wearisome. Ancient persons asseverate that business is worse than after the Baring crisis, or even the Overend-Gurney panic. Nothing is now seriously wrong, conditions are sound, money is accumulating, but the public refuses to join in the game. This is due, in part, to belated holidays, in part to continued nervousness, and most of all to disgust with the way in which shareholders have been fooled, especially in the Rhodesian and West African mining departments. The Prestea, East Rand, Anglo-Continental, and similar performances are not easily forgotten. Nor should they be forgotten. The only good that can come from such affairs is a salutary lesson, and a warning not to put money into the hands of people showing so little regard for the small shareholder.

Various recent issues have fallen flat, the underwriters being left with more than they desired. The bourses of Paris and Berlin have been weak, and New York has had troubles of its own, largely due to reformatory legislation.

TRANSVAAL.—The output of gold in September was 21,910 ounces less than in August, partly on account of the shorter month. Labour statistics continue unfavourable; the decrease of 5586 natives compares with a decrease of 12,019 in August this year, and a gain of 1628 in September last year. The shortage, mainly due to the strike, but partly seasonal, is not likely to be corrected for many months.

In our August issue, referring to the official statement of yield, cost, and profit, published by the Chamber of Mines, we referred to the "comparative worthlessness" of the monthly statistics as reflecting the actual results of

mining on the Rand. We were referring to the fact that the June figures did not indicate the increase of cost due to the labour disturbances. Our comment was only partly justified. The Kleinfontein was idle during the greater part of June; at the Van Ryn a majority of the men came out on June 19; and at the Modderfontein a number went on strike on June 21, but no actual cessation of work took place at the other mines. The general strike, with the riot, happened early in July. The statistics show that the average cost was 17s. 8d. in June, as against 17s. 7d. in May. Thus the labour troubles would appear not to have affected the cost, for 17s. 7d. is the minimum recorded during the current year. This seems to be out of harmony with known facts, as regards the loss of time and decrease of efficiency due to the beginnings of the trouble that culminated in July. In that month a much greater loss of time resulted from the strike, and extra expense was incurred by most of the companies. Twenty-three of them have disclosed an expense, on strike account, of £107,815, equal to 1s. 2d. per ton on the ore milled throughout the Rand. Other companies also incurred strike expense, but figures are not available to show how many included the item in their 'cost.' This, of course, is what vitiates the statistics, for the expense due to the strike was a part of the 'cost,' in that it diminished the 'profit.' Labour troubles, varying in degree, are just as much a recognizable factor in the economics of mining as the caving of stopes, incursions of water, or the other customary hazards of the industry.

The wild talk of the labour agitators and the disorder of the strike itself have intimidated the native workers so that they are disinclined to renew their contracts, despite the

offer of a bonus. In the kraals it is said that war is likely among the white men on the Rand; hence recruiting is much prejudiced. The efficiency of the native workers meanwhile is being increased by taking greater pains to check the illicit trade in liquor. During the strike many properties were surrounded by fences in order to exclude intruders, and as this had a markedly useful effect in preventing the sale of liquor to the natives, it has been decided by the authorities to compel the fencing of all mines.

The New Modderfontein is now one of the great gold mines of the world, and has splendid prospects of a long career of productiveness. The ore reserve on June 30 was estimated at 4,351,000 tons, averaging 34s. 5d. per ton (the 5d. is a meticulous detail). During the last financial year the yield has been 39s. 7d. (here the 7d. is significant, for it means a fact, not an expectation) from 565,400 tons. Mr. H. F. Marriott, consulting engineer to the group controlling the mine, admits that the output of ore is above average grade, this being due to the recent strike, the inadequate supply of white labour, and the consequent inability to distribute the stoping according to schedule. The southern portion of the property is opening up well, and the ground near the circular shaft is being connected by cross-cuts with the other workings.

The New Kleinfontein report contains an estimate of the ore in reserve at the end of June. This includes 1,174,463 tons of 7'7 dwt. ore, called 'payable,' and 511,323 tons of 3'64 dwt. stuff, called 'unpayable.' The total reserve is given as 1,685,786 tons, averaging 6'47 dwt. per ton. As the 'working' cost at this mine is 19s. 6d. per ton and the total (or real) cost is 23s. 6d. per ton, it is absurd and misleading to include rock assaying 3'64 dwt., equal to 15s. 6d. worth of gold, among the assets of the mine. This 3'64 dwt. is given as the 'value' of the rock. At the present time, and for a long time to come, it has no com-

mercial value whatever, for it can be exploited only at a loss.

A notable effort to exploit 4 dwt. gold ore has been abandoned in the case of the Jupiter. The inadequate labour supply and the consequent insufficient tonnage of ore for the mill at full capacity compels the directors to cease operations. For the six months to June 30 the 'profit' was 1s. 11d. per ton, but this profit, of course, was illusory, as it omitted several items of expense.

Electric blasting on a large scale has been adopted at the Meyer & Charlton mine. On September 30 the total charges exploded from the surface numbered 570. The workings, of course, were clear of miners. Only two misfires are reported. It is stated that the same method of blasting is to be introduced at the other mines of the Albu group. Our Johannesburg correspondent refers to this subject.

RHODESIA.—The gold produced in August is stated to be 59,555 ounces, worth £250,576, which is a slight increase over July and the second highest monthly output during the current year. The number of mines contributing is 199, as compared with 201 in July. The Globe & Phoenix, the leading mine, maintains a uniform output of slightly over 10,000 ounces per month. The Eldorado shows a decline, so does the Selukwe Columbia, but the changes are small.

The quarterly report on the Shamva gives 2,327,582 tons of 5 dwt. ore as the total reserve. The orebody has been cut in two places at the fourth level, exposing widths of 80 and 40 feet respectively. A rush of water has stopped further exploratory work for the present.

The significance of the Giant deal with the Cam & Motor lies in the fact that it appears to acknowledge the failure of the effort to find the faulted orebody in the Giant mine. To restore its fortunes, now obviously declining, it has been arranged to acquire prospecting

rights on the Cam and Good Shepherd claims of the Cam & Motor company. In the circular it is stated that the Cam-Good Shepherd lode, which is distinct from the Motor lode, has been opened up to the extent of 102,628 tons, having a gross value of £227,478, with confident expectations of increasing this tonnage by further development. The statement of gross value is not informative; it means nothing; what is the profit expected from the tonnage specified? The announcement fell flat, as the arrangement will not be of immediate financial benefit to either company.

The report of the committee of directors that went to the Globe & Phoenix will be awaited with interest. As they and their friends have insisted that the mine has been depreciated, and other Scottish shareholders have talked vaguely about bear tactics, we shall not expect a convincing statement. The board ought to have sent an independent engineer to make a report, instead of deputing a party of prejudiced amateurs to perform a task so difficult and important.

Since the above was written, Mr. Archibald Bowman, a director, has had to resign in consequence, it is said, of his having sold his shares. He was a member of the deputation that went to the mine and was supposed, as a coal operator, to know something about gold mining, being thereby differentiated from his colleagues.

Two water-jacketed furnaces have been at work at Katanga, for the Tanganyika Concessions, since the beginning of July. About 4000 tons of copper is reported to have been produced in the first eight months of this year, while in July and August the two furnaces produced 1900 tons together. Fine ore is being briquetted. The company is now making its own coke, at a cost said to be satisfactory.

Further evidence concerning the discrepant assays at the Falcon is afforded by some large check samples taken by Messrs. Walter Currie and J. Black, the assays themselves being

made by the Standard Bank of South Africa. The results appear to confirm the official assay-plan, on which a grave doubt was thrown by the report of Messrs. Ackermann and Pickering. These gentlemen remain silent.

The mill of the Bell Reef is to start at the end of the current year, crushing 4000 tons per month. At least, that is its capacity. The plant includes crushing, roasting, amalgamating, and cyaniding departments.

WEST AFRICA.—The output of gold in August was 30,247 ounces, which is slightly less than in July, and also less than in the previous August. For the first 8 months of this year the total production has been 260,587 ounces, as against 225,913 during the corresponding period last year. Among individual producers the Abbontiakoon and Ashanti show increases, while the Broomassie and Taquah exhibit declines.

Among the Nigerian flotations to which exception was taken in these columns more than a year ago was the Boma. We referred to it in April, 1912, as an example of misplaced liberality in estimation. The report by Mr. L. H. L. Huddart bore evidence of carelessness, for which an accounting has now been made. It is a regrettable affair. However, we cannot forbear a smile at Mr. Albert F. Calvert's letter in the *Financial Times*, directing attention to discrepancies between promise and fulfilment. We see the wraiths of a Westralian boom jibbering in the twilight.

Another shock to the Nigerian market was given by the Juba circular, confessing a wide divergence of opinion between Mr. A. W. Hooke, the manager, and Mr. J. J. Hunter, who has made a recent report. The manager claimed in December that he had "proved" 3554 tons of black tin on the 442 acres prospected. Mr. Hunter finds nothing of the kind. The consulting engineer, Mr. C. G. Lush, on whose report the property was purchased, considers Mr. Hunter's conclusions "premature." Meanwhile, the Comte G. de

Venancourt, a director and a mining engineer, will proceed to Nigeria to ascertain the true position. If M. le Comte has had no experience of alluvial tin mining, his report will serve only a highly decorative purpose. Here again what is needed is an independent engineer with special qualifications, not a person already financially committed to the enterprise.

The Abu and its prospects have been discussed in the financial Press. We agree that 14 years' experience in a country and the ability to speak the native language are qualifications insufficient for appraising tin prospects, but such qualifications if added to general experience in mining for tin are most useful. The calabashing of natives is, of course, an unreliable method of sampling, preparatory to systematic work.

The Naraguta Extended sets a good example in publishing not only the output of tin, but the estimated profit. So far so good. The next thing to do is to deduct the average London expenditure, taxes, and other general expenses and give the shareholders a statement of the actual profit earned, as nearly as can be ascertained, on each month's shipments of tin concentrate.

The finding of a river outlet suitable as a port for the terminus of the new trunk railway to Nigeria was announced on the same day as the discovery of the buried ruins of a port through which the commerce of Pompeii found an outlet two thousand years ago. The one in Nigeria is to be called Port Harcourt. Deep water, high cliffs, and a creek that is really the main channel of the Bonny river are the salient features. From Port Harcourt the railway, 530 miles long, is to be built to the Udi coalfields, thence to the Benue river, and along the edge of the Bauchi plateau, connecting with the present railway at Kaduna.

CANADA.—A stampede to placer diggings on Sibola creek, in British Columbia, is announced. A telegram issued by the Agent-

General states that the scene of the discovery is 100 miles south-east of Telkwa and that "the creek is now completely staked." We hope it may prove to be no repetition of the Bitter Creek fiasco.

The publication of particulars concerning the North West Corporation marks a further organization of Yukon mining. This corporation is formed to acquire Mr. A. N. C. Treadgold's holding in the Granville company and his claims on Indian and Dominion creeks, estimated to cover 600,000,000 cubic yards of profitable gravel. Mr. Treadgold will be the manager; indeed, the North West enterprise presents an unscrambling of the Granville egg, the interests of Messrs. Treadgold and J. W. Boyle being separated for exploitation by the North West Corporation and the Canadian Klondyke Company, respectively. The areas controlled are distinct, and sufficiently large to occupy the energies of a capable manager, who, in both cases, is a pioneer of acknowledged ability in this branch of mining. The Granville becomes a holding company, controlling 75% of the North West Corporation and 50% of the Canadian Klondyke Mining Company.

Some excitement has been caused at Dawson by local friction between the Yukon Gold and the Canadian Klondyke companies, the latter having threatened to dredge the land upon which the former's machine-shops and warehouses were standing. However, no blood was spilt. Work on the creeks has been crippled by lack of water, due to a mild and open winter last season. All signs point to an early and hard winter this year.

The Anglo-French Exploration Co. is said to have increased its holding in the Hollinger mine from 9500 to 21,000 shares, as the result of a favourable examination of the present condition of the property.

INDIA.—Development at the Nundydroog has been so satisfactory during the last few months that the directors are considering the

advisability of reverting to the rate of output, 8500 tons per month, which was reduced to 7500 tons at the beginning of 1913, at a time when developments were causing anxiety. The progress reports show that at several points excellent ore is being found. The 2900-ft. level in the Oriental section has passed through the dike, and the lode beyond it assays nearly 3 oz. gold per ton over a width of 9 inches. At the Balaghat, after many months of disappointing development work, a lode 2 ft. wide and assaying 6 dwt. per ton has been discovered at a depth of 3175 ft. Though this would not be profitable to mine, the discovery gives heart to the explorers. It is with pleasure that we chronicle the arrival of the Anantapur goldfield at a dividend-paying stage. The North Anantapur company has announced a distribution of 10% on the 25,000 preference shares.

AUSTRALASIA.—The reports of both the North and South companies at Broken Hill disclose, as we intimated two months ago, the erection of a plant to treat the accumulated and current slime. Both companies should increase their dividends shortly, having ample resources. The second half of the year is usually more favourable to good returns, as work is less interrupted by holidays. The South Blocks mine, of the Zinc Corporation, is developing particularly well. On the main lode the orebody has widened to 90 feet on the 8th level and the west lode has now been opened up for a big distance. This new west lode, characterized by an excess of zinc, represents a mineralized zone west of the old main lode; it has been opened up in the Block 10, Proprietary, and South mines, but in the North mine this auxiliary deposit is as yet unprospected. In the South mine the exploratory drilling has yielded highly pleasing results, proving the existence of an orebody 31 feet thick (averaging 16% lead, 10% zinc, and 4 oz. silver) west of the foot-wall of the branch lode going south from the main orebody. This ore

has been traced from the 825-ft. level to the 1070, enlarging at the lower level. In order to exploit this orebody the No. 4. shaft is being enlarged.

The Lancefield is to go into liquidation. After a long and various effort to find a metallurgical process capable of treating the ore at a profit, it has been abandoned as hopeless. An indebtedness of £40,000, chiefly in Western Australia, has been accumulated. The lesson is that it is dangerous to buck against refractory ore that is also low-grade.

The geological report of Mr. Malcolm MacLaren indicates that the lode in the Kalgurli mine has passed finally from the quartz-dolerite, which he considers favourable to ore, into calc-schist, which is decidedly unfavourable. He advises against deeper exploration.

The later information from the Associated Northern confirms the inference we made three months ago concerning the Victorious mine, namely, that the rich orebody is not persistent in depth. The work done on the 5th level discloses a decrease in the gold contents of the ore, which is also more refractory than in the upper workings.

UNITED STATES.—On October 5 the town of Nome was almost destroyed by a terrific storm, which demolished several hundred houses and destroyed property valued at \$1,500,000. Fortunately, the last steamer for the 'outside' cannot have left, and migration is, therefore, possible before winter.

The cutting of a big width of 12 dwt. ore on the 2000-ft. level of the old Plymouth mine must be highly gratifying to the California Exploration Co., and to its engineer, Mr. W. J. Loring, of Bewick, Moreing & Co.

The suspension of operations at the Washoe smelter for two weeks was a good reason for the concomitant firmness of the copper market, for that big plant of the Anaconda Copper Company produces about 1200 tons of copper weekly. On the other hand, it is curious that when the Rio Tinto strike began, the effect of

it was to depress not only Rio Tinto shares but those of other companies likely to benefit from a decrease of copper shipments from Huelva.

The Oroville Dredging Co's report includes a statement from one of the directors, Mr. T. J. Hoover, conveying the result of a recent inspection of the company's property in California. This statement is frank and clear. It indicates the approaching end of profitable operations at Oroville, the dredging ground being expected to be worked out in 1918. Next year the profit from Oroville will drop to £13,600. Meanwhile, the new Pato property in Colombia will become productive, yielding £50,000 per annum in 1914 and during the succeeding years up to 1920. Outside the limits of the tested ground on the Pato concession, in Mr. Hoover's opinion, there are prospects, but the alluvium is shallow and the gold contents are comparatively low. On California hill there is some gravel, but it will have to be hydraulicked, not dredged, and will, therefore, require the erection of an entirely separate plant. On the whole, the assured resources represent an ultimate profit of 15 shillings per share, leaving the unappraisable prospects on one side. The present worth of the shares, assuming a return of 15 shillings in six years, is about 6s., their present market price. The dredge on the Pato is working well and is giving returns somewhat higher than the estimate. This estimate is based on a report by an engineer specially qualified in alluvial mining, Mr. C. H. Munro, and we shall be surprised if the story of the enterprise does not confirm the accuracy of his sampling.

MEXICO.—No real change in conditions is reported. The election is due to take place shortly. Huerta is not a candidate for the presidency. Felix Diaz is returning to Mexico, to push his own candidature. Gamboa has announced himself as another competitor, representing the clerical party.

At El Oro, Pachuca, and Guanajuato ab-

solute tranquillity reigns. In the states of Morelos, Guerrero, and Durango, conditions are appalling. The towns of Taxco and Durango have been sacked. In Chihuahua and Sinaloa the conditions are slightly improved. A later telegram announces the capture of Torreon by the rebels, followed by a massacre. This incident will have an effect in decreasing the metal output at the smelter.

Early in September the directors of the Buena Tierra had to announce that no dividend would be declared, "in consequence of the continued strife in the Republic of Mexico," whereby the Chihuahua smelter had been operated intermittently and other hindrances to their operations had been caused.

The El Oro report suggests wise management throughout. The purchase of the Ofir claim for £130,918 has been followed by the development of ore estimated to yield a profit of £200,000. Re-treatment of accumulated tailing has eked out the tonnage of mine ore. The reserve has increased during the year from 301,934 tons averaging \$9'26 to 448,053 tons averaging \$9'90 per ton. The local railway, owned by this company, yielded a profit of \$117,983. In his speech Mr. R. T. Bayliss referred to the appearance of shale in the lower workings and said that Mr. A. F. Main believed it likely that the andesite characteristic of the deeper part of the mine is only an intercalation of small vertical extent. The same idea was expressed by Mr. H. A. Titcomb in the Esperanza report issued in May. If this proves true, it affords promise for profitable development in depth.

The daily Press has contained "official details" concerning the San Martin mine, in Oaxaca. The names of Messrs. Thomas J. Ryder and E. M. Hamilton are mentioned in connection with the mining and metallurgical phases of the enterprise. Both are men of good repute. Details, however, are lacking. A reserve of ore valued at \$2,000,000 is mentioned. How much of this is profit? A mine

may have \$2,000,000 gross in the form of so-called ore that will not yield a profit, or a profit disproportioned to the capital involved. We are informed, on excellent authority, that the orebody in the San Martin is a shoot only 240 feet long, and that extensive lateral development failed, not long ago, to find other orebodies. At that time it was estimated that even the persistence of the shoot in depth would not give returns adequate to amortize the capital required for purchase and plant. Later development may justify the valuation placed on the mine, but proof is required.

RUSSIA.—It is reported that a railway is to be built from Irkutsk down the valley of the Lena to the Bodaibo region.

A correspondent states that 'the woods are full' of American engineers in the Lena region of Siberia. Rumours are current of rich finds of gold-bearing gravel in the far north.

The speech of Mr. Leslie Urquhart, the chairman of the Tanalyk Corporation, at its first annual meeting, indicates that the enterprise has mining rights over an enormous area, namely, 24,300 acres, besides prospecting rights over 2000 square miles of Ural territory. The obtaining of this concession from the nomadic Bashkir community must have involved a great deal of patient negotiation. From the report it appears that about 70,000 tons of ore, averaging 2.9% copper, with 7.4 dwt. gold, and 7.5 oz. silver per ton, has been opened up during the current year. Indications in the bottom, especially at the Mambet mine, are most encouraging. Mr. R. Gilman Brown expects that the first unit of the smelter will be in operation in March next, and the second unit three or four months later. Then the plant will have a capacity of 220 tons of ore per day, producing 1500 tons of metallic copper annually. It will be noted that the gold contents are relatively high, so that half of the value of the copper bullion will be in the form of gold and silver.

At Kyshtim a large gas-fired regenerative

reverberatory furnace is being erected for fine ore and flue-dust. This is a new departure of technical importance, the waste heat from the reverberatories being recovered, not by applying it to boilers, but by regenerating the gases.

VARIOUS.—An expedition organized by Sir William Mackenzie has gone to Labrador on an exploration of two years, making headquarters this winter on Repulse bay, in the northwest of Hudson's Bay. Mr. R. J. Flaherty is the mining engineer who will direct the search for mineral deposits.

No definite news is forthcoming concerning the new gold discovery near Kilo, in the Congo Free State. The recent find was made near the head of the Ituri river, which rises from the ranges on the western side of Lake Albert. The country is granite and hornblendic schist. We learn that near Nizi, which is 20 miles northeast of Kilo, quartz speckled with gold is abundant, but in small patches. The larger and more promising lodes are being costeaned.

Renewed attention has been directed to tin mining in the Malay States by the issuance of the Ipoh Tin Dredging prospectus. The company comes out under good auspices, Mr. Reginald Pawle being one of the three directors, with Mr. M. T. Nelmes Bluck as consulting engineer. Reports have been made by Messrs. Bluck and H. D. Griffiths, the latter, of course, being the successful manager of the celebrated Tronoh mine, in the same district. The capital does not seem excessive, and the information is satisfactory, with one exception; and even that is in regard to a detail habitually overlooked in prospectuses. The working cost is given as 4½ pence per cubic yard; we do not impugn the accuracy of the estimate as far as it goes, but we insist that the prospective shareholder should be told not the 'working' cost at the mine but the *total* cost to be deducted from the yield, in order to arrive at the money likely to be returned in the form of dividends. The Ipoh

is said to have 178 acres containing 11,300,000 cubic yards likely to yield tin worth £800,000. How much of this is net resultant profit? Not £594,795—the amount stated—because sundry other inevitable items of expenditure have been omitted in the estimate of cost. For instance, the Government royalty is omitted; besides this there are income tax and London expenses—all an integral portion of the cost of mining. The total cost will be about 6d. per yard.

The successful development of a coal-mining enterprise in Spitzbergen is noteworthy. We refer to the Arctic Coal Co., controlled by Mr. John M. Longyear and under the resident management of Mr. Scott Turner. The island of Spitzbergen is a *terra nullius*, it is a region of political go-as-you-please. Either Sweden or Norway might have taken Spitzbergen long ago, if they could have come to some agreement. They did not. Only last year, at an international conference held at Christiania, it was suggested that a joint control be exercised by Sweden, Norway, and Russia; but the scheme came to nothing. Mr. W. S. Bruce, when appearing before the British Association, urged our Government to annex the island. If we remember correctly, he is one of those heroic Arctic explorers who have been rescued by the people engaged in productive industry on an island that is visited every summer by excursion steamers. The Arctic Coal Co., operating near Advent bay, is an American enterprise, and sells its product (at the rate of 70,000 tons per annum) in the Scandinavian and Baltic ports.

We wrote in a recent issue concerning the orebody in the Burma mines as being one of the largest, and most refractory, discovered in the last decade. In a statement made by Mr. H. C. Hoover before the meeting of shareholders, he gave the length of the orebody so far proved as 600 to 700 feet, 50 feet wide, and averaging 25 oz. silver, 25% lead, and 25% zinc. These figures are easy to remember. He also referred to a copper lode, 7 to 8 feet

wide, assaying 8 to 10% copper, 10 oz. silver, 10% lead, and 10% zinc. Since the meeting a cablegram has been received announcing that this Shan lode has widened to 35 feet and assays 14% copper. If this rich ore should persist for any length, it will change the whole aspect of the enterprise, assuring an output of docile copper ore, pending the endeavour to ascertain a method for treating the big supply of refractory lead-zinc ore.

The transport of machinery to the Mawchi tin mine is being effected by elephants. A statement of cost would be of technical interest. While the assembling of the plant has been delayed, as is not unusual in such cases, the mine itself is opening up well.

The dredging operations undertaken in Spain have proved a failure. Work has been suspended by the Spanish Goldfields pending a search for the 'pay channel.' This should have been done a little earlier in the proceedings. The result confirms the information given by Mr. James Howlison in his article on the River Sil in our issue of March last, and it is in accord with our own warnings on the subject.

OIL.—The withdrawal of the Spies Petroleum group marks the recognition of a great disappointment in oil exploration. The Maikop Spies Company has decided to cease its operations in that oilfield, where in October 1910 this same company had a big gusher. The territory thus discarded has been sold to the Maikop Victory, which is apparently more confident of success. It is now known that the Maikop oilfield is not a true anticlinal deposit but a disconnected series of pools or pockets. Some of these were big enough to make gushers when tapped, but deeper drilling has yielded no such results as were confidently anticipated during the boom three years ago. Five deep wells are been sunk at the present time, and on them hinges the surviving hope of those financially interested in Maikop.



THE PRESENT CONDITION OF THE MAIKOP OILFIELD.



SELISOVIK, NORWAY, ON THE WAY TO SPITZBERGEN.

EDITORIAL

ANOTHER example of editing by committee is afforded by the latest bulletin of the American Institute. It contains a paper on 'The Tin Situation in Bolivia,' meaning the present condition of tin mining in that country. One of the sub-heads is 'Future of the Bolivian Tin Situation.' When a situation has a future, a cabbage will have a soul.

EVIDENTLY the gentlemen styled Constitutionalists in Mexico do not appreciate valuable technical information, presented in an easily digestible form, for the copies of the *Mining Magazine* sent to subscribers in Sonora and Chihuahua are being returned so mutilated that it suggests the use of them as missiles in one of those heroic battles of which we read from time to time.

WE understand that Mr. Frederick H. Hatch, Ph.D., Bonn University, has been selected as the next president of the Institution of Mining and Metallurgy. The choice will be received with gratification not only by his many friends but by the profession in general, to whom it will be a matter of keen satisfaction that the science of geology should be honoured in the person of one who has so thoroughly demonstrated the advantages of applying the study of the rocks to the exploitation of ore deposits.

IN OUR LAST issue we referred to the fact that the mining companies in the Transvaal are compelled to furnish the Government with an estimate of life, as a basis for taxation. This estimate is treated as confidential by the Mines Department, but it ought to be available to the shareholders also. Owing to the number of typists and other minor officials to whom this information becomes

known, it is subject to leakage, and reaches persons having much less right to it than the proprietors of the mines, that is, the shareholders. The publication of the official estimate of 'life' would serve alike as a check on taxation and a corrective of over-valuation. In other words, it would contribute to truth, which should be the foundation of an art to which science is applied in the search for gold.

IN HIS BOOK on 'Alaska; an Empire in the Making,' Mr. John G. Underwood writes: "The Treadwell operates the second largest stamp-mill in the world. It is exceeded in size only by the De Beers property on the Witwatersrand, South Africa."

What has New Zealand done, that the Dolcoath should be forgotten?

GOLF is the pastime of many interested in mining. The digging of divots is congenial and congenital. The placing of a small ball into a small hole with implements ill adapted to the purpose is a technical problem that most mining engineers seem to like. Thus the Mining and Metallurgical Club has its Golf Association, which, on September 25 held its autumn meeting on the links of the Royal Wimbledon Golf Club. The 36-hole bogey competition for the trophy given by Messrs. Hooper & Speak was won by Mr. Edgar Anderson; the second prize being halved by Messrs. Edgar Rickard and George Gonsalves.

THE FINANCIAL PRESS on September 19 published three statements to which the name of Colonel Sir Augustus Fitz-George, K.C.V.O., was appended. All of them gave technical information concerning those silver mines at Cobalt in which British

capital is interested, through the medium of companies of which this distinguished soldier is chairman. With every desire to be fair, we are impelled to comment on the fact that a military training is no apprenticeship for mining. To be a K.C.V.O. is honourable, but to give trustworthy information on mines the distinguished order of M.E. is more to the point.

AN "important public announcement" is cabled from Johannesburg. It states that the mayor of that city (a Mr. W. R. Boustred) has declared that "the reefs of the Witwatersrand will still be unexhausted seventy and eighty years hence." Of course, election to the mayoralty indicates a special knowledge of mining, and municipal experience connotes unusual facilities for acquiring familiarity with economic geology. For ourselves, the dictum of the Bishop of Pretoria or the Commander of the Forces in South Africa would be equally acceptable. The only person whose opinion on the economic future of the Rand mines is worth having is that of an independent mining engineer. Such an opinion was published in this Magazine recently.

RESPONSIBILITY of companies for the health and life of those in their employ is now generally recognized. With it must go the obligation on the part of workmen to undergo medical examination. Usually such examination is resented, but an interesting exception is found at the Copper Queen mine, in Arizona, where the men willingly undergo heart examination with a view to ascertaining their susceptibility to shock from the electric current. The voltage of the electric system in the mine is only 225, which is innocuous to a healthy person, but it has proved fatal to those having weak hearts. Knowing this, the men are glad to be tested. Similar tests for infectious diseases would be more valuable, in so far as they would protect

not only the afflicted person, but those whom he might infect in the course of his daily labour.

GOLDFIELD, in Nevada, was damaged by a cloud-burst on September 13. An emergency edition of the *Daily Tribune* recalls the experience of some of us during the San Francisco earthquake-fire. A single sheet, set by hand and printed on a small job-press, did duty for the ordinary voluminous pages given by the *Tribune* to its readers. This single sheet, printed on both sides, provided an excellent condensation of the world's news, as well as a stirring story of the local happening. We read that when the heavy rain-cloud burst on the adjoining hills a foaming wall of water tore its way down the canyon and swept through the red-light district of this mining settlement. We leave it to a novelist to make the most of this stage-setting.

THE MISLEADING character of some of the compilations offered to the public as a guide to so-called investing in mines, is illustrated by the tabular statement published periodically by the *Financial News*. It is fundamentally wrong, for "the declared profit for 1913 to date" is given as a basis for dividends, being followed by a column stating the "amount required to pay a 10% dividend"; as if all the so-called profit were available for that purpose. It is not. Of the fictitious 'profit' only from 60 to 65% is distributable to shareholders. In 1912 the 'profit' of all the mines on the Rand was £12,678,095, but the actual dividends amounted to £7,952,994, showing that only 63% of the 'profit' reached the shareholders. Thus the use of the 'profit' announced monthly is entirely fallacious as a guide to the real earning capacity of a mine. Next we demur strongly to the estimates of life. The East Rand is given 30 years at the rate of 30% dividends per annum. This disregards all the known facts. The Jupiter is

estimated at 22 years, while, in fact, it is moribund. The Nourse is given 25 years, as against a probable 18. In the case of the Brakpan, the compiler gives (?), which is honest, although the data available justify an estimate of about 30 years. In the case of many of the mines quoted, it would appear as if the estimates had been repeated from last year, without regard either to the passing of time or the later information available. The whole elaborate statement is honeycombed with errors and absurdities. Some of these are humorous, but the results of publishing them, as a serious guide to non-technical readers of the financial press, must be highly injurious to legitimate business.

WHEN READING the names of the directors constituting the board of the Oroville Dredging Company we wondered what recondite reason explained the connection between oil-flotation processes and the exploitation of gravel containing gold. Mr. Theodore J. Hoover has been a director for two years, and Mr. A. Stanley Elmore has been elected recently. We were right; there is a connection between two kinds of technology not obviously related. It is to be found in Herodotus; that ancient chronicler tells a story of Carthaginian virgins, on an island called Cyraunis, who collected gold from the mud of a lake by the use of feathers daubed in pitch. When this was given as evidence in one of the various suits incidental to this belligerent branch of metallurgy, Mr. Justice Darling, as usual, made one of those feeble witticisms that throw ridicule on the administration of the law.

'POSSIBLE' ORE is a dangerous term. More than one incident recently has led us to this conclusion. 'Probable' ore is loose enough, for the significance of it is slight until we know the user's idea of probability. Promoters and jobbers are apt to confuse prob-

able ore with an assured reserve, to the discomfiture of an honest engineer who may have meant to be particularly careful. As to 'possible' ore, it cannot too soon be regarded as an impossible technical term. Ideas of possibility are too indefinable and individual ideas concerning such abstractions vary too widely to come within the limits of scientific measurement. To the young and optimistic, and more especially to the careless and flamboyant, almost anything is possible in mining, and even the slimmest evidence suffices to prove the presence of valuable ore. To the old and experienced, the possibilities are circumscribed, and even the most alluring of them have to be recognized as beyond the range of immediate business. One man's possibility is another's probability; the positive ore of one engineer seems only probable to another; and in some cases the 'positive,' 'probable,' and 'possible' all seem improbable to the detached onlooker. The fact is that conventional terms are apt to be employed in lieu of detailed description. If an engineer states the character of his evidence, it is easy for most of us to decide how conclusive it may be. At present, with the loose use of 'positive,' 'probable,' and 'possible,' we are no farther ahead than we were in the days when 'ore in sight' covered a multitude of absurdities. The cure for that was found by enjoining engineers to explain what they meant; that is the cure for the slack use of these later substitutes.

DISCUSSIONS concerning the lack of business on the Stock Exchange are in vogue now, just as the sea serpent and the earliest cuckoo serve for correspondence during other dull periods. Such discussions in the daily Press are useful in causing brokers, jobbers, and speculators alike to pause and think a little. The general depression is not all due to the Balkan wars or to other distant causes. It is partly the consequence of flagrant manipulation and unscrupulous promo-

tion. Speculation on the Stock Exchange is recurrently made a good deal less respectable than gaming in a second-class casino. The company without a prospectus and the company that does funny business through subsidiaries are among the latest developments lending themselves to chicanery. Sometimes the scandal is such as to provoke a demand for Board of Trade interference, but the time has arrived when some measure of reform may be demanded from authorities nearer home. We refer to the Stock Exchange Committee. Is it not time for this organization to put its house in order and to check those of the members of the Exchange who are killing business by wrongful practices? In the end the Exchange suffers most by the destruction of public confidence, for it leads to a diminution of business. Meanwhile, as we have said before, the good health of the mining department depends mostly upon the mining engineers. Even the most reckless or the most crafty of jobbers, brokers, or promoters, must employ the engineer to give a look of technical respectability to their financial vagaries. If the Stock Exchange Committee will awaken to its responsibilities and the Council of the Institution will gather a little more courage, it is likely, not that wrong-doing will cease, but that it will be made increasingly difficult and proportionately unprofitable.

By the Way.

The critic of mining affairs, however cheerful his general outlook on life, is apt to seem a melancholy onlooker. Unlike the reviewer of books, he rarely gets the chance to praise with freedom or to commend with emphasis. Indeed, the game is played with so great a disregard of rule that he has no datum points from which to measure the performance. It looks like a go-as-you-please and a devil-take-the-hindmost, a tragi-comedy compounded of as much bathos as pathos. For instance, it would be delightful to be able to assert that

our information concerning the Golden Blank mine enabled us to state that it was more valuable than was generally supposed, and that our own appraisal on the facts as published was higher than that expressed by the market quotation. That is an infrequent contingency, at least as regards mines that are the subject of public speculation, for the simple reason that the market price is usually a lap ahead of the development. Mines are persistently over-valued because good news is exaggerated and bad news is suppressed. As to conduct in the administration of mines, we find it necessary less often to praise right doing than to condemn wrong doing, simply because the first, being regarded as normal, calls for no comment, while the second, being a deviation from the moral line, demands censure. It would be impertinent to praise an honourable man for going straight or to applaud an honest man for refusing to steal. Hence the commentator, like the judge, has to make more frequent references to infractions of the code than to the observances. Yet it is satisfactory to realize that the infractions are abnormal and that a vast amount of quiet business is done in accord with the standards recognized among honourable men. Indeed, the criticism of certain kinds of performance could not be effective if the general mental attitude of the community were not in cordial sympathy with the critic's indignation. It is a part of his duty to keep alive, and keenly alive, the detestation of commercial obliquity so that those who are inclined to transgress may be deterred thereby, and those who are timidly inclined to do right may be fortified thereby. Laws and regulations derive their force from the fact that they are the concrete expression of the sentiment of a community on matters of conduct; they are guide-posts to the erratic and finger-posts to the vicious. Our errant human nature requires such assistance; it needs such warning. We see the effect of them on the business of mining. The Companies Acts, the regulations

of professional societies, such as the Institution, and the critical watchfulness of the more thoughtful newspapers are among the agencies working for righteousness. Like Disraeli at Oxford we are on the side of the angels; we believe in counsels of perfection, not in suggestions of imperfection. Any fool can wander down-hill; it requires initiative to climb. We see signs of a quickening appreciation of the duty that the mining profession owes to the public interested in mines and mining shares. We see evidences of a greater solidarity among the members of that profession. These are full of promise. The bettering of the mining business must come by a raising of professional standards and the recognition by the public that its financial safety lies in the skilled advice of men free to express unprejudiced opinions.

Directors.

The two directors, Colonel Weston Jarvis and Mr. H. L. Stokes, who resigned from the board of the Bell Reef Development Company, deserve more than a bonus equal to six monthly fees. The resignation was prompted by a appreciation of the fact that the board was needlessly large and that three directors would suffice to administer the company's affairs. Here we have a rare recognition of the fact that boards of directors are usually unwieldy in numbers and proportionately expensive in maintenance. The larger a directorate the less the individual sense of responsibility; not only that, but we maintain the paradox that the sense of honour is lessened by addition. On most boards there are one or two men, sometimes one only, who dominate the council-room and control the policy of the company. It is well that such men should be made responsible for the administration, taking either the credit or the blame, as may be. A board of seven or nine, of whom only one or two are really effective, is expensive, not so much in fees as in the scattering of initiative and moral

obligation. The time will come, we hope, when a directorate of three will be deemed sufficient, such a board to consist of one managing director, acting as chief executive, with two others to aid and advise him. We would not suggest an economy in fees proportioned to the diminution of directors, but advise the payment of higher salaries to abler and more competent administrators, who should be regarded not as the representatives of blocks of shares or as speculators privileged to obtain early information, but as trustees for all the shareholders, who are the owners of the mine. If an increase of salary comes to directors with an increase of work and responsibility, then two other results may ensue: they will devote themselves to two or three enterprises, at most, instead of serving as stool-pigeons on many boards, and, finally, they will become recognized not as lures for the unwary, figure-heads for promoters, amateurs in a highly technical business, but as professional men.

Secondary Enrichment I.

So long as geology dealt in generalities and theorized over the source of the metals, it failed to convince the miner. Like the Yorkshireman and his claret, the miner 'got no forrader.' When the geologist began to elucidate the structural relations modifying the natural concentration of ore and when he commenced to explain the causes combining to produce particular enrichments, then the miner looked up and began to take notice. Here was the professor telling him where to find a bonanza; here was the expert helping him to make money. Economic geology was justified when the theory of secondary enrichment made good. It was a great event in the application of geology to mining. Our own recollection of the development of this inductive reasoning from observed facts leads us to give credit first to Mr. R. A. F. Penrose, whose paper on 'The superficial alteration of ore deposits,' published in 1894, contained, we believe, the

germ of the idea that became developed in the papers of S. F. Emmons and Mr. W. H. Weed, both published in 1901. With them must be mentioned Mr. Horace V. Winchell, who, as geologist to the Anaconda Copper Company, furnished some of the facts on which the scientific presentment of the theory was based. Indeed, it is to Butte, and the clear evidence obtainable in the copper mines of that celebrated district, that we owe the first development of this phase of ore deposition. Renewed attention to the subject is assured by Bulletin No. 529, recently published by the United States Geological Survey. In that bulletin Mr. W. H. Emmons has brought together all the evidence bearing upon 'The enrichment of sulphide ores.' He has compiled and digested the literature available, and has stated his own conclusions therefrom in a manner that will be highly appreciated by members of the mining profession, to whom such a treatise on such a subject is, of course, invaluable. Incidentally, we desire to record a cordial appreciation of the courteous and scholarly references made by Mr. Emmons to all who have written on this particular topic; indeed, his foot-notes are so complete as to constitute a bibliography of the subject up to the end of 1912.

When exposed to weathering, the metallic sulphides are decomposed, yielding both soluble salts, which are washed downward, and minerals, which remain in place. The simplest and most important case is that of pyrite, which, when exposed to air and water, forms the limonite of a gossan and the sulphuric acid that reacts on the underlying portions of an ore deposit. Thus are produced the soluble sulphates that migrate downward until they reach a depth where air is excluded. There they are reduced to sulphides, either by precipitation on other sulphides in the unoxidized portion of the ore deposit or by contact with the unoxidized wall-rock, which is usually alkaline. In this way the metals dissolved from the cap

of an ore deposit become re-deposited at a relatively shallow depth, forming enrichments of great economic importance. That enrichment takes place usually at, or near, the water-level. This is the horizon at which mine workings penetrate ground full of water. It is the upper limit of the zone of saturation, the bottom of which is reached in deep mines when the rock becomes so dry as to be dusty. Above the water-level the country-rock, and more particularly that portion of it included within lode-channels, is readily permeable to the descending meteoric water, or rain-fall, and is consequently charged with air, affording free oxygen. Hence this upper region of the vadose circulation is especially the zone of sulphates and other products of oxidation; of its products, the insoluble oxides remain in a leached and impoverished outcrop, while the sulphates descend until they arrive at the water-level, where they are arrested by chemical or structural conditions, and surrender their metallic constituents, so as to form a concentration or enrichment. In ground that has been fractured by recurrent faulting or in rock otherwise rendered unusually permeable, this enrichment may extend deeply. As a rule secondary enrichment is found at less than 1000 feet, but in rare cases it extends to more than 2000 feet in vertical depth. Of all deposits, those of copper are most illustrative of these geological activities. It was at Butte, in the study of the copper ores of that district, that the hypothesis of secondary enrichment was evolved. The lodes traversing the granite contained ores of copper, associated with an appreciable proportion of gold and silver. In several instances they were worked first for gold, the outcrop having been deprived of its copper and silver by weathering, so as to leave the least soluble metal in concentrated form. Within a hundred feet in depth the gold contents diminished rapidly, and silver became relatively important, in an oxidized copper ore. Below that, and at the level of ground-water,

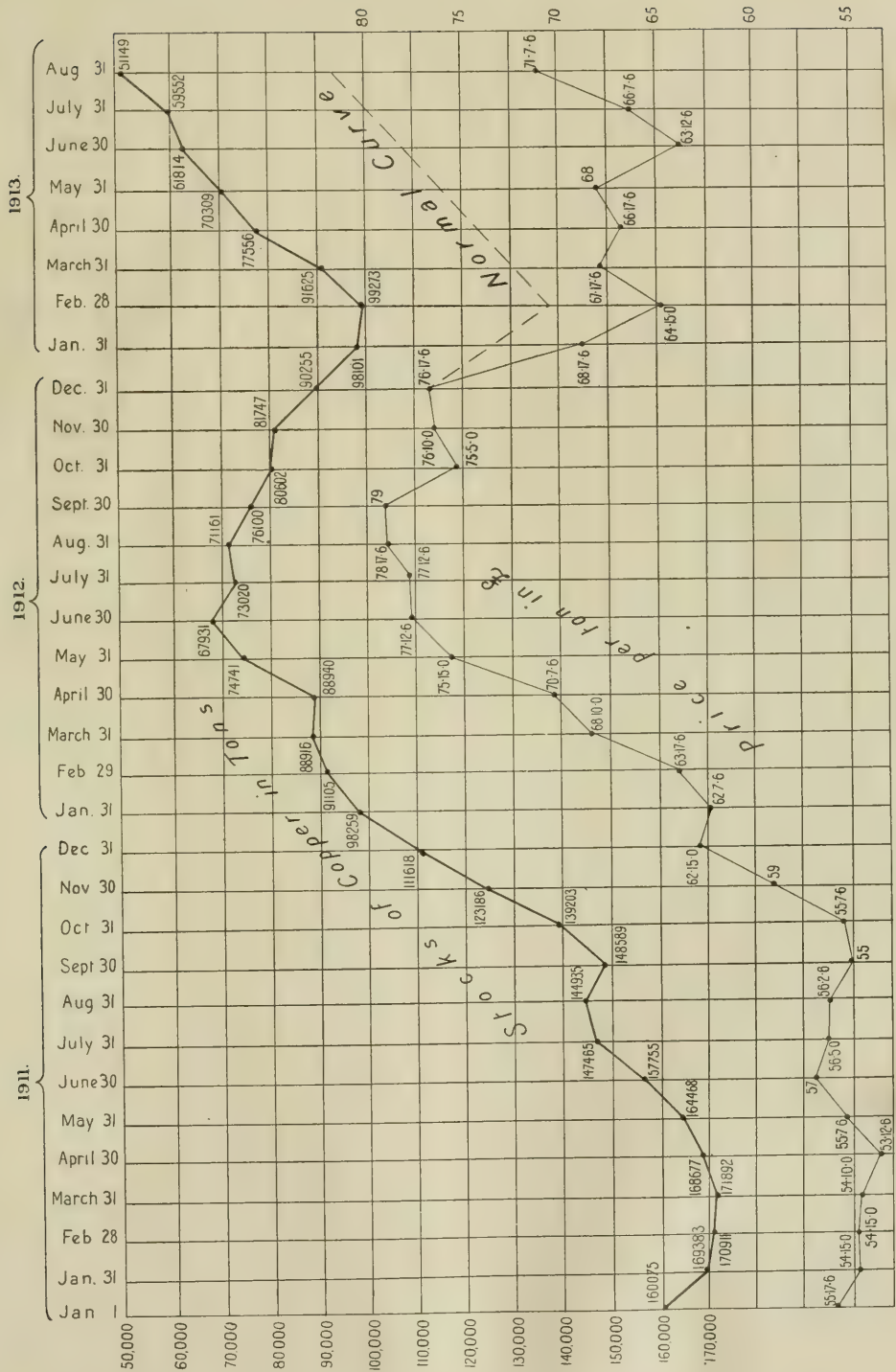
at about 300 feet below the surface, the bonanza zone of rich silver ore, with copper sulphides, was struck; and below that again the silver decreased rapidly while rich, even richer, copper ore persisted to greater depth. This richest copper ore was characterized by the mineral chalcocite, Cu_2S . This was the story of mining in one or two special instances, such as the Gagnon and Parrot mines. In the case of the Anaconda and other more typical copper veins, the successive changes were of a different character. There the outcrop was nearly barren of copper, which had been leached by weathering, leaving iron-stained quartz in a vein-filling of altered granite. Under the outcrop was the oxidized copper ore. Oxidation persisted to a variable extent, but 250 feet may be taken as an average. Down to the bottom of this zone, oxidation is complete. The transition to sulphide ore is sudden, within a few feet vertically. Immediately beneath the lower limit of oxidation comes the zone of sooty chalcocite, that is, a dull black coating of chalcocite on pyrite and other sulphides. This extends for a vertical depth of as much as 1000 feet, passing irregularly into ore enriched by massive chalcocite, which, in turn, renders some of the Butte veins highly profitable down to a depth of nearly 3000 feet. It is generally agreed that the sooty chalcocite is of secondary origin, but it is claimed, not without good reason, by Messrs. Reno H. Sales and Horace V. Winchell that the major portion of the massive chalcocite is of primary origin. By 'primary' is meant mineral that has "remained essentially unchanged by superficial agencies since the ores were deposited." This is a definition given by Mr. Emmons, whose writing on the subject underlies much of the foregoing outline of the facts of the case. Indeed, his essay is intended to be a summary of existing knowledge with a view to suggesting "lines of approach to the problems to be solved." Such a result depends, he says, largely on the observations of

those who go underground daily and watch the successive changes in different parts of an ore-body, as it is excavated. This is true. Mining engineers can render important help. In this connection we may mention the fund raised among a group of American copper companies in order to promote further research into the crucial question of the secondary character of chalcocite. This is a notable recognition of the value of geological inquiry as applied to the search for ore, and more especially to the search for those extraordinary enrichments that spell dividends.

Copper.

On the opposite page we publish a diagram expressing in graphic language an apparent anomaly in the present price of copper. This diagram is based on one published early in the current year by Henry R. Merton & Co. It is merely an intelligent compilation of facts. The upper curve shows the fall in the stock of metal, while the lower curve indicates the fluctuation in the price of the metal; normally the price ought to rise as the stock diminishes; which is, indeed, the fact, as is shown by the general parallelism of the two curves during 1911 and 1912. In 1913, however, the curves diverge, so that while, on a similar basis, the price of copper at the end of August ought to have been £85, it was only £71 per ton.

The explanation of this anomaly is not easy to ascertain. The irregularity in the price-curve at the end of 1912 and the beginning of the current year is due largely to the Balkan war, which began in October 1912. In that month the price dropped sharply. The even steeper fall in December and January was also, in all probability, caused by disorganization at the financial centres, reacting on world-wide industry. The more recent failure of the price to respond to the improvement in general conditions is difficult to explain. Some of it may be imputed to hidden stocks of metal, for it must be acknowledged that the estima-



tion of the world's store of copper at any given date is apt to be vitiated by several unknown factors, among which may be mentioned the proportion of metal in the hands of the refiners. It is true, consumption has increased steadily, and at the present time, as stated in the Rio Tinto report, is in excess of production, but the statistical position taken by itself is apt to be misleading. Production has been outstripped by consumption partly because the political disorder in Mexico has prevented the mines of that country from delivering their quota, and a big strike in the Lake Superior district has cut off 20% of the normal American output for six months. The knowledge that these interruptions were temporary must have checked hasty elation at the depletion of stocks. But this is not all. The copper market is highly speculative. At the present time there is fully 50,000 tons of metal bought on bull account; and as against this bull account there is an equivalent bear account, traceable mainly to producers ensuring themselves against loss due to a lower price on the metal they will send to market in the near future. One of the larger American companies has sold its output of copper nine months ahead. Such facts go far to explain the irresponsiveness noticed between the statistical position and the market price.

Bwana M'Kubwa.

The Bwana M'Kubwa copper deposit in Northern Rhodesia, and not far from Katanga, has been the sport and plaything of the promoter for long enough. The metallurgical end of the business has been starved and advice has been bought cheaply. Shareholders and the public have been kept in the dark as regards the policy of the board, and visits of inquiry to the offices have been barren of results. The first really open act of the directors was the publication last month of Mr. S. J. Speak's report on the property. This report gave for the first time an intelligible

account of the nature and extent of the ore-body, and the description and diagnosis of the nature of the occurrence may be freely admitted to do credit to the author. On the other hand the part dealing with the metallurgical problem is not convincing. The cause for his failure to provide a solution is probably twofold. In the first place Mr. Speak is not a copper metallurgist, and secondly the 'terms of reference' as to the nature of the inquiry greatly circumscribed its scope, in that the directors desired a method whereby immediate profits could be derived. We shall discuss in detail the deposit and metallurgical problem on the facts disclosed by Mr. Speak. The ore-body consists of two wide beds of quartzite dipping nearly vertically, separated by a narrower bed of honeycombed silicious material, which at depth changes to a silicious dolomite. The quartzite contains chalcocite with some carbonate disseminated throughout its mass, and each bed is 30 to 60 feet thick, averaging 4% copper. By a slip of the pen, Mr. Speak says "bornite" instead of chalcocite; that this is an error is indicated by his subsequent remark that very little iron is present in any part of the mine. The intermediate bed or the central orebody, as it is called, is rich in carbonate of copper within the zone of alteration, the average of the 50,000 tons proved being 12% of metal. At about 350 ft. where the silicious ore gives place to silicious dolomite the grade drops suddenly and the contents becomes similar to that of the quartzite beds. Mr. Speak is of opinion that all these beds were sedimentary, the quartzite being a dolomitic sandstone and the central band a dolomite. The ascending cupriferous solutions permeated all the beds, and the accompanying silica filled the interstices. A secondary action following the oxidation of the sulphides removed the dolomite from the central orebody and deposited the carbonate, leaving the mass porous. This central orebody may be taken therefore to be in the nature of a secondary

enrichment. The source of the ascending solutions is not clear, for owing to the country being covered with a deep layer of soil geological investigation is difficult, and up to the present time the presence of any igneous rock in the neighbourhood has not been reported. The extent of the orebody may be gauged by Mr. Speak's estimate that in each quartzite bed over half a million tons of 4% copper ore is proved between the first and second levels. The rich ore of the central orebody, of course, is limited and, as already mentioned, Mr. Speak vouches for only 50,000 tons averaging 12% copper. This figure for the tonnage is only half the original estimate made by previous engineers, the discrepancy being due, as we recorded last month, to the specific gravity having been assumed to be that of solid rock, and not $1\frac{1}{4}$ as determined by Mr. Speak after he had recognized the porous nature of the ore. So much for the geological and mining features of the enterprise.

When freed from considerations connected with the present control of the owning company, the metallurgical problem does not appear to present insuperable difficulties. Limestone is obtainable at a quarry four miles away, and two sources of iron oxide are within 100 miles by railway, while coke can be brought from the Wankie coalfield, 500 miles to the south, on the line of the Rhodesian railway. The highly silicious character of the ore suggests preliminary concentration. This would be necessary and feasible in connection with the sulphide ore of the quartzite, but its application to the rich carbonate ore would be of doubtful utility, seeing that the ore crumbles and slimes readily. Mr. Speak is in a hesitating mood about water-concentration as applied to the sulphide ore, fearing that a large proportion of the copper mineral would be lost in the slime; but as his figure for the recovery, 65%, is approximately that obtained in practice in the disseminated chalcocite ores of the west of America, we do not share his trepida-

tion. He mentions tests with the Minerals Separation and Murex processes; as a matter of policy it would be better to postpone consideration of the slime. As regards any metallurgical treatment hitherto attempted, the only installation erected is a jig and table plant intended for producing a concentrate from the rich carbonate ore, suitable for shipment to Europe. Several hundred tons has been obtained in this way, averaging 37% copper and accounting for about 40% of the copper in the ore. At one time it was intended to erect a Siemens-Halske electrolytic plant for leaching the quartzite ore and the residue of the high-grade carbonate ore. An experimental plant is stated to have worked satisfactorily in England, but for various reasons, especially the first cost, the process has not so far been adopted at the mine. Probably also, difficulties of a technical character were encountered, for instance in connection with the anodes.

In reviewing the present position and the possibilities of treatment on a large scale, the item of fuel stands predominant. Though coal and coke are available from Wankie, the cost of carriage by railway is exorbitant. The Government railway charges the comparatively modest price of one penny per ton per mile, but its service ends at the Rhodesia Broken Hill, and for the remaining 117 miles to Bwana M'Kubwa the Rhodesia-Katanga railway charges no less than fourpence per ton-mile. This railway belongs to the Tanganyika Concessions group, and evidently a jealousy exists, which acts to benefit the Tanganyika Concessions smelter at Lubumbashi to the practical strangulation of the rival enterprise. Coke which is sold at 30 shillings per ton at Wankie costs £5 per ton at Bwana M'Kubwa, and coal very nearly as much. Bearing this in mind it is not safe to be positive in making recommendations as to the future metallurgical policy of the company. The general plan would be to erect a furnace to treat the rich oxidized ore, either a rever-

beratory or a blast-furnace. The blast-furnace would be more economical of fuel, but would be unsuitable to the friable ore. On the other hand the reverberatory, though well adapted to the physical nature of the ore, would involve a prohibitive expense in connection with the coal required. This cost would be substantially reduced if the reverberatory furnace was constructed on the regenerative principle, as at Kyshtim. We understand that the friable ore may prove to be amenable to the sintering process and that with the object of determining this point, Mr. Thomas Huntington, a member of the board, is making a personal investigation on the spot. It is clear that either by discreet negotiation with those in control of the Rhodesia-Katanga railway in respect of the freight charges, or by the devising of a method of rendering the rich carbonate ore amenable to the blast-furnace, it would be possible to start the enterprise on a sound basis. In the old days in Arizona practically the same problem had to be faced. The perfection of the process was not counted of so much importance as the extraction of sufficient metal at a small enough cost to pay for the early operations and provide funds for subsequent improvements. The smelting of oxidized copper ores is a comparatively unsatisfactory business, because a large proportion of the metal is lost in the slag, thus comparing unfavourably with the smelting of sulphides. But in course of time, when the sulphide ores come to the fore, it is possible to re-smelt these old slags by mixing them with the regular charge. During the time that the furnace was being built for the treatment of the rich carbonate ore, and for some time after it came into service, the policy would be to develop the sulphide ore and gain some information as to its persistence in depth. Concurrently, water-concentration plant should be erected, on a limited scale at first, to test the possibilities as regards percentage of recovery and the nature of the concentrate. It

might be a highly advantageous stroke of business to follow the example of the Tanganyika Concessions and build a railway for the purpose of reducing the cost of freight, and the opportunity might be seized of co-operating with the farming interests in the construction of the proposed continuation of the Lomagundi railway from the Eldorado mine to join the Rhodesian railway at Kafue, and even to construct a branch of this new line direct to the mine and so avoid the exactions of the Rhodesia-Katanga railway.

Cost of Producing Gold.

In a speech delivered before the Association of Mechanical Engineers, at Johannesburg, it was explained by Sir Lionel Phillips what mineral exploitation meant to South Africa. The figures quoted by him were impressive. Out of the £34,000,000 worth of exports from South Africa during the first half of the current year, not less than £27,000,000 represented mineral produce. Speaking of the gold mining industry of the Rand, the technical staffs included 2500 men receiving £1,119,900 per annum; 21,300 white workers receiving £6,747,000; and 178,375 natives, paid 53s. 3d. per month, or £5,690,000 per annum. Other costs, including recruiting, in connection with natives increased that item by £3,077,000 more, making £8,768,000 paid for black labour. Stores absorbed £9,754,000 and taxes £1,648,000. In addition, an aggregate sum of £1,000,000 is spent in minor expenses. Thus only £8,000,000 remained for dividends. Therefore, out of the total annual yield of gold, valued at £37,000,000, about £29,000,000 went to "the sustenance and advancement of the country." Sir Lionel added that "it was interesting to say that roughly 75 to 78% of the cost of producing the gold was expended in the act of producing it." But the remaining 22 to 25% is also a necessary expense of production. As a matter of fact, the so-called operating cost represents only from 60 to 65%

of the total, or real, cost. Directors and administrators of South African mines, not to mention shareholders, will always be radically wrong in their economics until they realize that the operation of mines from London under the system of joint-stock finance involves a number of expenses, all of which are as essential as the wages to workmen or the money spent on timbering underground. Thus we receive, month after month, a semi-official statement of the so-called 'profits' earned by the mines of the Rand; this is based on a subtraction of the operating cost from the yield. It is fundamentally fallacious and misleading. The 'cost' is only part of the total expense; it excludes taxes, depreciation, London expenses, and sundry other items as inevitable as the salary of the manager or the postage on correspondence; in other words, the "act of producing" gold from the banket of the Rand is manifold, as well as complex; it involves operations in London as well as work at Johannesburg. It includes the salary of Sir Lionel Phillips just as much, and just as properly, as that of the shift-boss in the Simmer & Jack mine.

What is a Professional?

Not long ago we undertook to define a 'profession.' The members of such specialized occupations are often described as 'professional' men, and the use of the adjective serves to link the member of a 'profession' with a 'professional.' This tends to confusion. The adjective, 'professional,' and the noun, a 'professional,' connote different ideas. Briefly, a professional is a person who earns money from an occupation in which another engages for pastime. The latter is called an amateur. They occupy themselves in similar mental or physical activities, but one does it for pleasure, the other for gain.

The member of a profession is usually a professional in the sense that he performs specified work for payment, but the profes-

sional is not always a member of a profession because he has not undergone the special education implicit in the idea of a profession. Let us take a clergyman, a mining engineer, and a golf professional. These three illustrate the differentiations suggested. The first has been a student of divinity, and has undergone a special preparation for his work as a teacher of the higher ethics. He is a member of one of the learned professions, but he is not a professional, because he is assumed not to work for gain. It may indeed be suggested that the hope of heaven is to him as the dream of the open championship to the professional golfer, but it is even more obvious that both are likely to take shorter views of life and to work well in the hope of a reward less ultimate. On the other hand, the mining engineer is in touch with both his brethren, for he has undergone a severe mental training and engaged himself in technical work for the sake, incidentally, of making money. Another inference is permissible. The clergyman works on deduction from principles; the golfer on induction from facts; the engineer uses the one method of ratiocination to check the other. In other words, he is scientific, while his friends are respectively theoretical and practical.

We think better of the amateur who plays cricket or golf well than of the professional. When an amateur becomes a professional he loses caste: a fact indicated amusingly by his loss of the prefix Mister. Why should this be? Because we do not like our games to be treated as remunerative labour, that is, as a means of making money. To Britons especially it is a tradition—and a good one it is—to take games joyously and to draw a severe line between such essentially pleasurable performances and the labours required in the winning of bread and butter. On the other hand, it is a social convention to deprecate the doing of some things for pleasure; for example, singing and painting. We have a higher regard

for the professional who is a singer or a painter than for the amateur who also sings and paints. Why? Because art is taken as a serious pursuit, as one worthy, not of joyous inconsequence, but of sustained purpose, as one to which a man's life, and not his idle moments only, should be consecrated. We even resent the idea of the casual performer competing with the consistent worker. Further, we think more of the professional artist than of the amateur, not only because of the devotion to his art manifested by singleness of purpose, but because the former usually performs so much the better. The purpose of an artist is to do the thing well; the purpose of the amateur is to amuse himself. On the other hand, in golf and cricket, the first purpose is to gain healthful exercise and mental relaxation; there the intensity of concentration involved in labour is out of place. The professional in cricket or golf is as much out of focus as the amateur in art or engineering. Life is enriched by differentiation; work when work is to be done; play when play-time comes.

Mine Managers as Valuers.

The discussion on this subject has proved interesting. It grew out of a suggestion made by Mr. F. E. B. Fripp in a letter that was published in our June issue, in the course of which it was implied that the managers of mines were not among those best qualified to appraise new mineral discoveries or prospects. On this Mr. Morton Webber wrote a thoughtful article, which appeared in our August issue, together with a valued contribution from Mr. George E. Collins on the kindred topic of 'Specialists.' These letters all hark back to one written by Mr. Stephen J. Lett on 'Scientific Prospecting,' appearing in our May number. Several aspects of a vital technical problem have received attention in the course of this correspondence, but, for the moment, we desire to concentrate attention upon one of them, namely: whether the manager or ad-

ministrator of mines is fitted to examine and value mines in a preliminary stage of development. Mr. Fripp says that he is not; because his ordinary duties do not involve the qualities of mind required for appraising prospects: he usually lacks the special geological training requisite for such work, and is accustomed to dealing with ore reserves that are proved rather than those that are problematic. This amounts to saying that he has not the scientific imagination of a geologist, nor a familiarity with the technology of ore deposits. With this view Mr. Morton Webber concurs, arguing that "the exceptional aptitude as an operator does not necessarily imply a similar qualification in the discernment of young properties possessing the ear-marks of important mines." To him the mine manager appears likely to "err on the side of conservatism," his habit of depending upon an assured reserve of ore causing him to fail in realizing that "the most speculatively important epoch in the life of a mine is in its early existence." He is apt to 'turn down' a promising young mine if the conditions do not resemble those with which he has become familiar in the course of his previous experience. To such pleas for intense specialization, Mr. George E. Collins demurs. He asks: "Is it not the fact that the very concentration of interest and experience which create the value of a specialist tend to make him take a dangerously narrow view?" He argues that the general practitioner is best fitted for the appraisal of mines, not the specialist, and that when a need for the latter exists, that need will be recognized by the general practitioner, who is also best able to make a selection of the particular specialist qualified for particular conditions. Finally, in this issue, we publish a letter from the type of man to whom the subject is of most vital interest, namely, the mine-owner. Mr. Richard Willis, the representative of those who foot the bills alike of managers and specialists, points to the salient fact that ex-

pert advice is costly. He expresses his chagrin at finding that a short inspection should entail an expenditure equivalent to more than two months pay-roll on the mine in question. This obstacle to the obtaining of professional advice is one that confronts all of us. The professional man charges for his time and trouble in performing a given task and he charges sevenfold more for knowing *how* to do it; in other words, like Whistler and his nocturne, he expects payment for "the knowledge of a lifetime." If the "mine-valuer of well known reputation" who happened to be in the neighbourhood had been able to 'help out' our correspondent, it is certain that his advice would have been worth more than two pay-rolls on a small mine on its way to becoming a big one; we think that Mr. Willis can complain not so much at the fee as the entire uncertainty as to whether he would have got an equivalent in advice. The appraisal of young mines is a task that tests the acumen of the very best. Whether the mine manager is best fitted for it, or the mining geologist, or the consulting engineer, is a question not lightly to be answered. Indeed, we are disinclined to accept any one of these sub-divisions of the mining expert as pre-eminently equipped for the task. Among the most successful seers in this field of prophecy we remember keenly observant geologists, clever engineers of the nomadic kind, solid mine managers, and mining men of an indefinite type, lacking technology but saturated with experience both above and under ground. We agree that mine managers, as such, are not particularly qualified to appraise young prospects, although we hold that a man who has not been a manager of a mine during some stage of his career is apt to be an unsafe valuer of developed mines. Technical men trained in mining geology are apt to be keenly observant of some of the evidence aiding a correct diagnosis, but they may overlook non-geological points, such as refractoriness of ore

and purely economic conditions. Of course, if they have had a wide experience in appraising mines and mining districts, supplemented haply by an apprenticeship in underground work, they will not overlook such essential points. Hence the best of them are well qualified for this special duty. Mining engineers nowadays are versed in the theory of ore deposits and they travel so widely that most of them are well informed concerning the geologic conditions favourable to the development of a successful enterprise. They know the ear-marks of a good mine when they see them, and they can detect the signs of weakness in those never destined to advance beyond a promising infancy of development. This is true of another type of man, always rare, and rarer now than formerly, namely, the observant and intelligent miner, of the shift-boss and foreman class. He has worked in mines at various stages of their development, he has seen many districts, he has read the technical press, and he has discussed the points at issue with engineers and other men better educated than himself but not better endowed with the knowledge essential to the appraisal of a prospect. He is like the experienced nurse, who lacks the science of the doctor and the acumen of the surgeon, but by familiarity with the symptoms exhibited by infants and by absorption of medical lore from attending physicians, has, by aid of a keenly sympathetic understanding, developed a rare perception of the inherent probabilities of a given case. On the whole, therefore, we are not inclined to accord to any one kind of specialist the monopoly of a rare talent; it is one of those judicial instincts for which no particular training can find a substitute; it involves not only observation and knowledge, but foresight, a gift neither inherited nor acquired, a faculty that may be cultivated by scientific education, by travel, and by experience, but in the last resort is so largely individual as to be beyond classification.

ROYAL SCHOOL OF MINES

The Association.—Subscriptions to membership continue to arrive, over 100 being now enrolled, without general solicitation. A card-index of old students is being prepared. It is urgently desired that not only will all R.S.M. men become members in advance of personal request by circular, but that they will transmit to the Hon. Secretary the names and addresses of their comrades at the School. When a fairly complete register has been prepared, it is the intention to circularize the old students, but not till then. The list formerly available was most defective, in that it included not only the names of deceased persons but also those who were merely guests of R.S.M. men at the annual dinners. Any suggestions or criticisms conducive to the usefulness of the Association will be welcomed by the executive committee.

Lectures in the City.—The enterprise of the Sir John Cass Institute in arranging for lectures on mining and metallurgical subjects was much appreciated by members of the profession in the City. Many of them found it convenient to attend dissertations given at the close of office-hours. This experience suggests the idea that the professors at the Royal School of Mines might arrange to invade the City occasionally for the purpose of giving lectures on special subjects such as are of more immediate interest to practitioners and to business men. The technique of the petroleum industry, the geologic search for the precious metals, and the sanitation of mines may be instanced as topics on which they would receive eager attention. If members of the teaching staff at South Kensington would contribute to the enlightenment of the City, it could be arranged to return the compliment by persuading some of our engineers and other practitioners to visit the School of Mines and give the students an occasional page from an experience gathered in many

mining regions. Among the engineers in the City are several both able and willing to co-operate in bringing the realities of mining before those preparing themselves for a similar career. Moreover, it might prove useful if some of the financial managers could give the students some idea of the relation of capital to technology, impressing the budding engineers with the important fact that the ultimate purpose of the arts of mining and metallurgy is to make money out of holes in the ground. Such exchanges of ideas and information would tend to increase the City's interest in the School of Mines, and, at the same time, forge a link of sympathy between youth and maturity, stimulating to both. The Students' Union building, opposite the Royal School of Mines, might furnish a suitable lecture-room for the one performance, while the Mining and Metallurgical Club would, we believe, judging from previous courtesies of the committee of the Club, afford the facilities required for a tea-time lecture in the City. This is the sort of thing that the R.S.M. Association might take in hand.

Junior Staff.—The recent changes in the demonstrators and assistant instructors at the Royal School of Mines has created a good deal of feeling, part of which is due to antagonistic opinions on the propriety of coaching. The prevalence of the latter has grown in consequence of the fact that the number of students has increased without a proportionate increase in the teaching staff. Undoubtedly the efficiency of instruction depends largely upon capable juniors, stimulated by a professor of strong personality. The choice of able men as professors will not suffice if their efforts are not seconded by the junior staff. To accomplish this, it is imperative that the instructors should be paid in proportion to their usefulness, not as if they rated with junior clerks in the City.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres.

NEW YORK

American Smelting.—In spite of the constant trouble in Mexico, where many of its plants are situated, the American Smelting & Refining Co. made a satisfactory showing during the first six months of 1913. During 1912 the net income of the A. S. & R. Co. and the American Smelters Securities Co., which are so closely affiliated that the accounts of the two companies are presented jointly, was \$11,079,676. The gross income for the first half of this year was nearly \$1,000,000 less than for the same period of 1912, but the allowance for depreciation was less than one-half of the allowance in 1912, making the net income only \$320,000 less than in the first half of 1912; corresponding to 4.12% on the common stock for the year as compared to 4.76% in 1912. The earnings for the second half of last year were unusually large, bringing the net earnings for the year up to 11½% on the common stock. If copper stays at or near 17 c. and lead continues to rise the company will probably show increased earnings for the second half of this year. This company has a great number of subsidiaries. It owns half of the common stock of the American Smelters Securities Co., the other half being held by the Guggenheim Exploration Co. The American Smelters Securities Co. owns the control of the Federal Mining & Smelting Co.; and thereby hangs a tale. Some years ago the lead ores of the Cœur d'Alene district of Idaho, where the Federal's mines are situated, went either to the smelter at East Helena, Montana, or to that at Tacoma, Washington. The latter is owned by the Smelters Securities Co., and the former by the American Smelting & Refining Co. Under the circumstances it was but natural that there was no 'destructive' competition for the ore output of the district, and the management of the Federal was glad to make a contract, extending over a long period, with the East Helena smelter on what were regarded as favourable terms. The mining world is one of quick changes, and not long after the Tacoma plant was converted from a lead into a copper smelter, the supply of copper ore from Alaska and the countries on the Pacific increased greatly. Meanwhile the International Smelting & Refining Co. had built a copper-smelting plant at Tooele, near

Salt Lake City, Utah. To everyone's surprise the expected supply of copper ore failed to materialize, and the plant has never operated at above half its capacity. The management thought to 'hedge the bet' by building a lead blast-furnace. This was done and the supply of lead ore was so surprisingly large and the profits so gratifying that more lead furnaces were built, and finally a lead refinery was constructed near Chicago. With a vigorous rival bidding for ores in the Cœur d'Alene region prices for ore rose, smelting charges went down, and the independent miner waxed prosperous. The Federal company continued at its old rate, which did not disturb the management, since it did not greatly matter whether profits accrued to the A. S. & R. Co. directly, or through a circuitous course as dividends on the Federal and Smelters Securities shares. The minority shareholders in the Federal company felt quite differently about the matter, and, under the leadership of Sydney Norman, have been endeavouring to void the contract between the Federal and the Smelting company. So far they have had but little success.

The strike of the Lake Superior Copper miners makes but slow progress toward settlement. The managers have rejected two arbitration proposals made by the Department of Labour of the United States government, on the ground that they can have no dealings with the Western Federation of Miners, which represents only a small number of the employees; that the more important companies are all operating, the Calumet & Hecla having 80 to 85% of a full force at work; that the Western Federation of Miners is only an obstacle to adjustment, and that no grievances have been presented by the miners. The companies seem favourably disposed toward granting the 8-hour day, but declare that a minimum wage-scale is impracticable under local conditions. Meanwhile Judge O'Brien of the County Court has issued an injunction restraining the members and officials of the Western Federation from molesting or disturbing the employees of the mining companies. It is practically certain that the Western Federation will under no circumstances be recognized and that the strike is practically ended. But it will be some time before the labour supply of

the district gets back to its former basis and the output of the companies will be below normal for several months. It is fortunate for the Lake operators that the strike has not interfered more seriously with the production. When the strike was called nearly half the stock of copper in this country consisted of Lake copper, which commands a higher price than electrolytic on account of its fancied superiority. Users of Lake copper have not been obliged to fall back on electrolytic to any great extent and have not convinced themselves, therefore, of the fact that for practically all purposes electrolytic copper of the present standard of fineness is as good as the more expensive Lake brand.

The Mexican situation does not seem to clarify any better than a solution full of colloids. Just as the public in this country was coming to believe that Huerta was showing a good control in Mexico City, he had a sharp clash with the Mexican parliament over the appointment to his cabinet of Sr. Urrutia, a Catholic, and was worsted. Elections are announced for next month. The impression is general that Felix Diaz is the most promising candidate, but he seems to be lacking in energy and effectiveness. Sr. Gamboa has resigned from the cabinet in order to accept the nomination of the Catholic party, and seems to be a strong candidate. Meanwhile Huerta is making arrangements for a commission to settle the claims of foreigners for damage during the revolution. It is proposed that this be international in character, but with a majority of Mexican members. It is estimated that the railroads alone have suffered a property loss of over \$100,000,000 in the past 3 years, and the National Railways of Mexico will require the expenditure of over \$75,000,000 to put it into normal condition again. Upon some divisions it will be necessary to re-build the road from road-bed up. More than 6000 miles of line are in unsatisfactory shape; bridges, water-tanks, stations, and shops have been reduced to ashes. The only satisfactory part of the railway is that outside of Mexico, and it is reported that efforts are being made to sell this. Newspaper estimates of the American claims are placed at \$10,000,000, while European claims are said to aggregate a larger sum. Much of the loss sustained by foreigners cannot be made the basis of a valid claim, for it is a recognized principle of international law that a government cannot be held responsible for losses caused by those of its nationals over which it has no control. So that many of the companies that have sustained losses will have

to be prepared to swallow them. In the midst of these alarms the El Favor mill is adding 15 stamps, two tube-mills, and corresponding concentration and cyanide equipment to its present 20-stamp mill. The new equipment will be used only for the Mololoa ore. The old mill will run exclusively on El Favor ore, of which 150,000 tons has been blocked out in the mine. A new process has been worked out to treat the El Favor ore, which has a high manganese content, and is said to have given good results in laboratory tests. The importance of manganese in ores is apparently only just coming to be recognized. W. H. Emmons has studied its importance in ore deposits and a host of investigators have worked over the problem of the cyanidation of silver ores containing manganese.

MELBOURNE.

Prospecting.—The fates have not fought in the cause of mining during the past month. All round the industry shows the sign of wear and tear, and of weariness over labour discontent. What Australia needs more than ever before is a revival of the old prospecting spirit that in the past sent men into the recesses of the country to search for an Eldorado. The one obstacle to anything of this kind is the pauperizing of the working classes by our legislators. Neither State nor Federal politician is exempt from blame in this connection. A change cannot be expected until the community has been faced with one of our old-time drought experiences. Then nature will compel resort to individual effort instead of State benefaction. No reason exists why history should not repeat itself in that respect. Hard times drove the pioneers to Silverton and thence to Broken Hill. Still worse times led to the prospecting done ten years later by the men who found Coolgardie. Australia has a huge extent of unprospected territory, but of course the country is so inhospitable that only men prepared to face great hazards and trained to live in the back country are qualified to do the pioneering. Once upon a time capital would have been forthcoming for prospectors of this type but both men and money are lacking at the moment. The reason for this condition of affairs has already been stated, but the desire to get rich for one-self is latent in the miner and the announcement of a new find in any part of Australia together with a taste of hard times would soon send the prospector way-back as of old.

Kamunting.—It is the lack of inducement in Australia that has led a small band of Sydney

and Melbourne people to send to the Federated Malay States a properly equipped party of prospectors to secure for them areas of alluvial tin-bearing ground. The pioneer in the matter was W. H. Pratten of Sydney and with him stood the brothers Freeman, one a mining engineer well known in Western Australia and the other a solicitor. They first picked on land at Kamunting but preliminary boring done by one of their prospectors, Horton, was at first so disappointing that when a representative of British capital offered to buy into the claim, for which a solid price had been given, he was

in Sydney at a time when times are dull and capital scarce. This venture makes the seventh company promoted in Australia to work alluvial tin in Malaya. In the case of the Tongkah Compound and the Tongkah Harbour the returns have far exceeded expectations. Australians therefore have been stimulated to go into the country on a still larger scale and if the two recently floated companies do well then prospecting will be even more vigorously pushed ahead by capitalists here.

Broken Hill.—The fall in the price of lead and zinc during the past half year was not



A FORE-HEARTH FOR SEPARATING COPPER AND MATTE.

gladly admitted. Systematic boring revealed that the ground averaged about 1 lb. of tin oxide per cubic yard. So London took a lease and floated it, giving the Austral-Malay Company (the Sydney company) 20,000 shares and a small cash consideration. The adjoining area has been now floated into a company with a capital of £150,000, of which £130,000 has been issued. The working capital is £50,000 and it is intended to put two tip-top Australian-built dredges on the new area. The prospectus issued is a model of its kind, and whether work with the dredges furnishes the tin expected or not, it is rarely that a set of men have been seen checking and counter-checking one another's work as has been done by this little Australian group. The whole of the cards have been put on the table, with the result that the issue of the shares was rushed

overlooked by investors in the mines of the Barrier, but they were altogether unprepared for the results shown by the Broken Hill Proprietary, the North Broken Hill, and the South Broken Hill companies in their half-yearly accounts recently issued. The South company made the worst showing, for its profit fell from £217,000 to £119,000. The decrease in the case of the North company was relatively small, but in the case of the Proprietary it was about £40,000. The latter company with its large register kept its quarterly dividend down to the reduced rate of 1s. per share but the two other companies each paid their former rate—6s. per share by the South on 200,000 shares and 2s. per share on 600,000 shares by the North. Such a reduction in profits can only be ascribed to higher costs, a fall in the price of metals, or the lower grade of the ore.

mines 50,000 tons of 24% ore, chiefly copper glance, and 60,000 tons of 10% ore, with a quantity of lower-grade material. In the first instance the mine was owned by one Henry, a pastoralist, who sold it for £100,000—£70,000 cash and £30,000 of debentures—to a Sydney group. This in time placed it under offer to London financiers, comprising, so it is understood, some of the Consolidated Gold Fields folk. Their option was up on July 31 and it was not till the last moment that the Sydney group knew that no deal was to be made. As some financial obligations had been incurred by a central figure in the group in connection with the company the power existed with certain people in London to impose pressure. The result was that, despite negotiations with Melbourne people, London ultimately secured the mine on easier terms than originally. Still it nearly lost it. The only other piece of news is that the Mount Cuthbert mine, mid-way to Mount Oxide from Cloncurry, has got all the capital it wants from its supporters. These have been determined to keep London influences out of the company, and so a purely Australian controlled property now will be alongside the Mount Elliott, the Hampden, and the Mount Oxide. W. H. Corbould, of the Mount Elliott staff, however, is consulting engineer.

SAN FRANCISCO.

Panama Canal.—Water is to be admitted into the Culebra cut on October 5 and thereafter excavation will be entirely by means of dredges. On August 1 less than 1,000,000 cubic yards remained to be excavated from the canal prism proper and between then and September 15, when steam-shovel work ceased, about one-third of this was expected to be accomplished. After the steam-shovels stopped work, 20 days were allowed for removing equipment from the cut and for drilling and blasting the bottom before the water was admitted and the dredges set to work. Considering the fact that 36 miles of track had to be torn up and 650,000 cu. yd. of material drilled and blasted, the time was not too long. Final admission of the water was to be accomplished by blowing up the Gamboa dike, which was built in 1908 to protect the cut from inundation by freshets from the Chagres river. Prior to destroying the dike, water will be pumped into the cut through four 26-in. pipes now used for drainage. This is to afford a cushion behind the dike. It would have required 17 days to fill the cut by pumping alone. Dredges will be kept in the cut for some time, not only

to remove the material from the bottom but to care for the influx from the slides at the side. In addition four steam-shovels, two on each side, will be kept busy at upper levels 'lightening the load' as a precaution against other possible slides. These slides, be it noted, have caused more anxiety abroad than at home. In fact, they have cheapened the work of widening the prism. While it is now recognized, as was urged at first by some of the engineers, that it would have been better to take off the load in the beginning, it was no great mistake in design that was made when one allows for the prevailing state of ignorance regarding stable slopes in tropical countries, when the digging began. Certainly few would have anticipated earth moving on a 10° slope; and yet that has occurred along the Canal. Fortunately it moves into a position for favourable attack and the extra expense has not been serious. The Culebra cut has been considered the largest single piece of work on the Panama Canal, and admission of water to it brings a realizing sense of how nearly that great work is done.

Anticipations of the profits that are to flow from completion of the Canal have been widespread. It will not be long now before some measure of them can be made. Probably it will be found that the profits accrue slowly and already it is becoming evident that they have been unduly anticipated. Here in California there has been wide expectation of an increase in population, particularly of a much needed influx of agricultural labour. With that in view large tracts of land have been divided and placed on the market, California thus joining the other Western states in a land boom. There are signs that this has gone beyond the safe point; that prices have been put beyond the level at which a producer can buy and yet make a profit. In fact the land market is now stagnant, or worse than that. Of interest to mining men in this connection is the fact that the work of the Natomas Consolidated has thereby received a check. There being no sufficient demand for lands when reclaimed, it has seemed better to modify the original plans, and, while the president of the company, F. W. Griffin, and the general manager, S. L. G. Knox, have gone to London to consult with the directors, it seems clear that only a part of the Natomas lands will be prepared for farming at this time and possibly none will be placed on the market. This does not influence the gold-dredging end of that great enterprise which, I am glad to say, is going on with clock-like regularity.

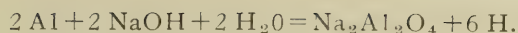
Oil.—Another field in which completion of the canal will shortly introduce a change is in that of petroleum. Aside from the probable increase in market due to stimulation of West Coast industries and larger shipping on the Pacific, opening of the Canal will permit delivery of California oil at Gulf ports and farther east at rates bound to result in some expansion of the market. This is the more true since unstable conditions in Mexico continue to discourage enlargement of production in the Tampico field. Undoubtedly much more territory there will prove valuable, but at present it is out of the market, and it is easier to hold a customer than to win one. Production in the oilfields continues to increase, but so does consumption, or rather shipments that are used to measure it. Prices are still low, but there is no increasing surplus and any large increase in markets would be sure to have a beneficial effect. That markets are realized to be more important than production by those who know, is shown by the fact that the Shell-Royal Dutch combine spent the better part of ten years here building up a selling agency before attempting to buy production. In the latter direction they are moving slowly. Purchase of the California Oilfields gives the Shell an excellent foothold and rumours of other purchases may well be received with suspicion. In the meantime the Standard Oil Co. has succeeded in maintaining its position without being driven again to buy low-grade oil. By drilling its own ground enough crude oil has been found to meet all requirements in this direction, and the loss of the California Oilfields production can be easily made up, if desired.

TORONTO.

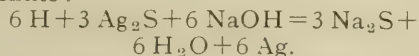
Cobalt mines have proved so surprisingly rich that financial wiseacres are continually looking for their end. The recent discontinuance of an 'extra' dividend that has been paid by the Crown Reserve, has been made the text of numerous preachments of the approaching end of production. No one recognizes more clearly than mining engineers that even the best mines ultimately cease to produce, but in the case of Cobalt, engineers probably have now more faith in the future than the layman. Demonstration of the fact that the veins occur below as well as above the basalt and that their richness is a function of their nearness to that great intrusive sheet, has afforded not only a guide for prospecting, but a sound basis for expecting a longer life for the district as a whole, than when the deposits

were thought to be enriched stumps of old veins mainly cut away by erosion. Individual veins are likely to lose their value rapidly, but the territory open to prospecting is large and the veins themselves are so rich that even small areas become significant. For example, at the Crown Reserve the various veins have been worked up to within 6 ft. of the bottom of the overlying lake. This ground will soon be available for stoping, as the water is now being pumped out of the basin. It is estimated that 6,000,000 oz. silver will thereby be rendered available. At the same time it will become possible to mine lateral extensions of the veins that cannot now be touched. No one can do more than guess what this additional ground will yield. It may be barren, but if it does as well as the ground already worked, there are 7,000,000 oz. more to be won. It is to be remembered in this connection that the success of the Seneca Superior, the feature of the last year as regards discoveries, was predicted on similar reasoning as to the value of ground lying between the Nipissing and the McKinley-Darragh. It was Mark Twain, I believe, who remarked that "the first requisite to a successful funeral is a willing corpse," and in this case that essential is lacking.

In metallurgy as well as in economic geology, Cobalt is teaching lessons. The high-grade mill of the Nipissing company, first described in *The Mining Magazine*, June 1912, afforded the sensation of 1912 and reflected great credit on the staff of the company and of Charles Butters, the consulting engineer. The low-grade mill is equally remarkable and the secret of its work has just been made public in an article by J. J. Denny, in the *Mining and Scientific Press* of September 27. Mr. Denny, who is metallurgical chemist for the Nipissing company, is the discoverer of the process, and James Johnston, of the Butters staff, is the builder. R. B. Watson, the capable manager of the Nipissing, has been the generous inspirer and backer throughout the development of the process. In brief, it has been found possible to decompose the complex sulphides, sulph-antimonides, and sulph-arsenides of the Cobalt ore and so render the silver immediately open to attack by means of a preliminary treatment of caustic soda solution in the presence of metallic aluminium. Mr. Denny believes the reduction to be accomplished by the action of nascent hydrogen resulting from the action of the caustic on aluminium according to the following reaction:

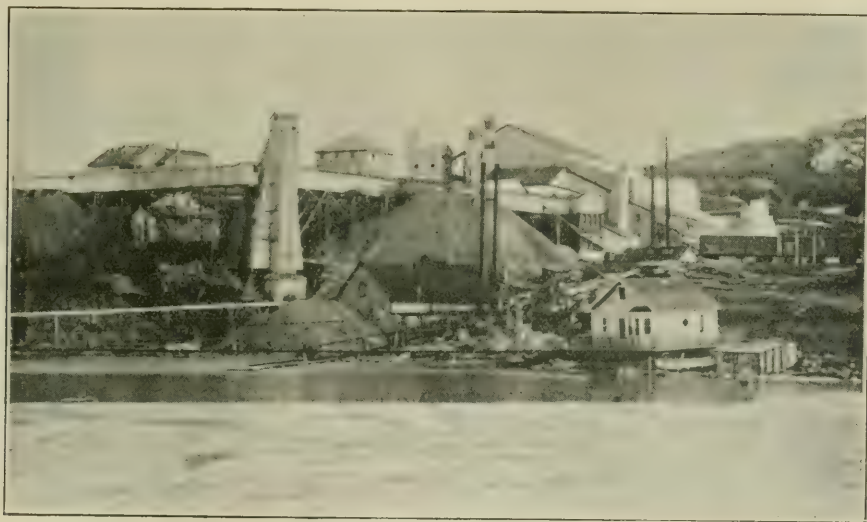


The hydrogen thus released reacts with the minerals present as follows in the case of argentite:



Similar reactions may be written for other minerals and preliminary experiments indicate that tellurides as well as sulphides are easily decomposed. This process is utilized by crushing in a 0.25% solution of caustic soda, adding 5 lb. lime per ton of ore, to facilitate settling. Fine grinding to a -200 mesh follows in tube-mills, after which the pulp is settled and excess solution returned to the stamps. The pulp passes through a second

possibilities of the use of the process are clearly large. Whether the explanation of the reactions given is final cannot now be stated. Some years ago, Paul W. Avery and Eugene C. Knowles, while working on the refractory or 'blue' ores of the Black Hills, found that KOH could be used to break them up, and later that NaOH could be in part substituted. The reaction was slow, and no sufficient body of ore being available, the process, although patented, was never adopted for regular practice. Their experience suggests the possibility that the main influence of the aluminium is catalytic, that it acts as an accelerator to a reaction that would none the less occur in time if it was absent. Clearly, how-



McKINLEY-DARRAGH MINE, COBALT.

tube-mill charged with aluminium ingots to vats for 10-hour mechanical agitation in the presence of metallic aluminium plates. Here the desulphurization occurs, and from here the material goes to a Butters filter, which delivers an unwashed pulp containing the metals and 26% alkali solution as moisture, to the cyanidation vats. Here it is agitated 48 hours in 0.25% cyanide solution, dilution 2.5 to 1; from here onward the practice is usual. The recovery in July, treating 234 tons per day of 27 oz. ore and poorer, was 93.16% measured in bullion. The cost, based on 7268 tons, amounts to 43.2 c. per ton for collecting, filtering, and transferring. The significance of this discovery will be at once apparent and the

ever, it is the critical element, and Mr. Denny deserves the greatest credit for his discovery.

Porcupine. — The Hollinger mine has greatly strengthened its position, and the four-weekly reports regularly issued continue to show increased profit and lower operating expense. The latest statement, covering the period ending August 12, shows gross profit of \$141,732, the number of tons treated being 11,466. The average value of the ore treated was \$18.37, the approximate extraction 97%, and milling cost \$13.87 per ton. The total profit from January 1 to August 12 was \$993,400, and the surplus \$625,202. There were 16 headings advancing in ore, of which two were on the recently opened 425-ft. level.

The vein at this depth maintains its character, and assays give a value of \$18 per ton. Twenty more stamps are being added to the mill, making a total of 60, with a crushing capacity of 650 tons daily. Foundations are being laid for a permanent central power-plant which will serve the Hollinger and the affiliated mining properties, including the Dixon, Gillies, and Miller Middleton. The Rea, which was taken over last winter on lease by the Rea Leasing Co., has been treating the ore on the dump accumulated during development with a 5-stamp mill, and the results have been sufficiently satisfactory to encourage the directors to add 5 stamps. Stopping is being done on the 200-ft. level, and a winze is being sunk on the vein. The plans of the Dome Lake directors for the re-financing of the company were approved by the shareholders at a recent meeting. Of the debt, amounting to \$61,000 in all, \$41,000 is due to the General Assets, Ltd., which will accept 45,000 shares in settlement, and 100,000 shares of the new issue are offered at 35 c. each to raise sufficient funds to pay off remaining liabilities and continue operations. The financial difficulties of the company were largely due to the strike of last winter. It has done a good deal of development and has large ore reserves. At the McEnaney the production of gold for August was approximately \$50,000, owing to a good discovery on the 100-ft. level, where ore was stoped for 23 ft. in the drift for a width of $6\frac{1}{2}$ ft., over which it ran \$130 per ton. Ten additional stamps and a cyanide plant will shortly be in operation. The properties abandoned by the Preston East Dome are being worked by Harry Offer and associates to good advantage. Smelter returns from $20\frac{1}{2}$ tons of ore taken from an open-cut ran \$175 per ton. A shaft is being sunk. The Pearl Lake has struck some high-grade ore in a rise from the 400-ft. level. The shaft is now down to the 725-ft. level, which is the deepest working in the camp. A large tonnage of mill-ore has been developed. The Jupiter has been temporarily closed down, market conditions being at present unfavourable for the raising of funds by the sale of treasury shares. Operations at the Swastika have also been discontinued until arrangements for re-financing can be effected. While fairly good returns were obtained down to the 200-ft. level, development below that depth proved unprofitable. The Wiseman claims, northwest of the Tough-Oakes, in the Kirkland Lake district, have been taken over by the Telluride Gold Mines, Ltd., capitalized at

\$1,500,000, in which English capitalists are principally interested.

Cobalt.—The Buffalo has increased its payments to shareholders. In addition to the regular quarterly 5% dividend, it is paying an extra dividend of 15% on October 1, and another of 7% on November 15. Including these payments, the company will have returned in all \$2,507,000, or about two and a half times its capitalization. The McKinley-Darragh is pursuing a conservative policy, and accompanied the announcement of the usual 3% quarterly dividend by a reduction of the extra dividend from 7% to 3%. The reason assigned was the cost of extensive explorations to increase the ore reserves and a large addition to the concentrating plant. Some very high-grade ore has been struck in the face of No. 40 vein at the 150-ft. level, which is too heavy to crush and is being hand-sorted. About 30,000 oz. per week are being taken out, and a heavy increase in the September output is looked for. The production for August was 212,098 oz. The Crown Reserve has found a new orebody at the 50-ft. level, and has cut $2\frac{1}{2}$ in. of high-grade ore on the 140-ft. level of its north vein. The draining of Kerr lake by the Kerr Lake and Crown Reserve companies is already beginning to realize the expectations that prompted the undertaking. The Kerr Lake company has so far picked up six new veins in the rock exposed, the largest of which has been traced for 50 ft., and carries 3000 oz. per ton. The Nipissing has decided that it will hereafter ship its silver bullion to New York, instead of from Cobalt to London direct, owing to the recent advance in express charges from Cobalt to London, making the rate between these points \$7 per 100 lb. The company has made trial shipments to New York on favourable terms. The Northern Customs Concentrator has placed what is believed to be the largest order for stamps ever given by a Canadian company, calling for the delivery of 60 stamps at Cobalt. An option held by a Montreal syndicate on the Gifford property adjoining the Beaver, has been allowed to lapse.

At the Keeley mine, in South Lorrain and now being worked on option by the Associated Gold Mines of Western Australia, another good find has been made. A 6-in. vein reported to run 6000 oz. per ton has been struck at the 61-ft. level. Gold ore containing platinum is reported to have been found at the Cobalt-Frontenac mine in the Elk Lake district. Two large orebodies, stated to give assays of \$22 and \$18 in gold, occur on each side of the shaft at a depth of 100 ft.

MEXICO.

Political.—The only new thing is a curious proclamation from the United States to say that the American Government did not mean their people to leave. This appeared in the *Mexican Herald*. Naturally, chopping and changing of this sort only increases the uncertainty. So far as internal conditions go, the position remains very much the same. There is a body of the rebels in the north still unsubdued, while in the south, in the state of Morelos, sporadic risings occur from time to time. On the whole, however, there is little doubt that the decision of the United States against the importation of arms and ammunition by the rebels has

dearth of information, the published statements still fall short of what is actually required, and it is hoped that *The Mining Magazine* will support the demand until regular detailed reports are issued by the company. The cutting of the orebody on the 20th level has caused considerable satisfaction, and it is hoped that the monthly profits of this company will gradually increase up to the estimates made last year. Mr. Cox, the consulting engineer, says that the actual reserves of ore at end of June amounted to 778,000 tons, that there is sufficient for four years' work, and that the profit for the present year should be 15%.



POLITICAL BANDITS ABOUT TO START.

made a considerable difference to them, and to their hopes, and they are rather dispirited.

Nobody seems to be quite sure of what is to happen about the Presidential election. Some suggest that it will be postponed for a year, while others take the view that Huerta will carry out the published programme, and hold the election. In that event, speculation is rife as to who the next President shall be, and on this point there is much conflict of opinion. There is a leaning to Felix Diaz, largely on account of his name. Provided that Huerta does all that the United States would have him do, there can be little question that the conditions in this country within a few months must see a great improvement.

Santa Gertrudis.—Although the directors have taken some notice of the agitation worked up in the newspapers, complaining of the

La Blanca.—The proceedings of the La Blanca company at its annual meeting are interesting. The chief points brought out are as follow :

1. The ore reserves at June 30, 1913, amounted to 361,000 tons, of an average value of over 50s. per ton.

2. The actual blocking of ore has only extended to the 10th level, at which horizon the orebody is 2 metres wide, assaying 2600 grammes of silver and the usual proportion of gold.

3. The capital expenditure on new equipment is practically finished, and it is quite certain that, within the next few months, there is to be an appreciable reduction in the working cost.

In view of the rapid increase in the monthly profits since the early part of the present year,

and the satisfactory condition of its reserves, the future prospects of the company are exceedingly good.

Other Mines.—The Natividad is continuing to do well, and is making about £1500 weekly. It is expected that dividends will be started at the end of the year. The Esperanza is still dragging along with a profit of only £6250 for July last, in spite of the statements of high-grade developments. The shares of the Peñoles, on account of the trouble in the north, have had a considerable drop, and are not likely to recover until conditions are again normal.

Ohio-Trinidad.—The shaft on this property, being sunk by the Denny Bros., has reached a depth of about 135 ft. The siding to the property from the Real del Monte railroad has been completed, and the new hoist and compressor, headgear, etc., have been delivered, and are in course of erection. Sinking operations will be suspended for a short period while the equipment is being installed, but it is expected that steady sinking operations will begin during the first week in October. It is stated that indications, so far disclosed in the operations, are of an encouraging nature. G. A. Denny is confident that the indications in this property will be found to be similar to those obtaining in the La Blanca mine, less than 2000 ft. away.

JOHANNESBURG.

Native labour still continues to decrease in quantity. This season of the year, the early spring, is always the occasion for an exodus of natives to their kraals to plough and sow, but this year the white labour unrest has greatly augmented the drain by frightening boys away and rendering those who are away disinclined to return. Natives from Portuguese territory are coming in as usual, but the more sophisticated Cape Colony boys are holding back for higher remuneration. At the end of August the native labour force employed in the Transvaal gold mines was only 158,223 as compared with 179,111 at the same date last year, and probably another six months will have to elapse before the position becomes normal again. In consequence of this shortage, development operations are being restricted at many of the mines, and the Jupiter is just on the point of closing-down altogether. This shrinkage in coloured labour has, of course, the effect of causing a shrinkage in the demand for white labour, and numbers of men are now out of work. The strike leaders are utilizing this fact to support wild

accusations of victimization, and generally to infuse a little new life into their worn-out platitudes. An opinion is rapidly gaining ground that from economic and humanitarian considerations it is desirable to employ natives underground to a much greater extent than has been the custom in the past, and to confine the white worker as far as is possible to the healthier surface work. There is much to be said in favour of this view; and the arguments against it, though many, are not very convincing. Should this opinion be ever given effect, it will mean fewer white workers underground of a better stamp receiving a higher wage.

The monthly cheque.—The method of payment hitherto in vogue throughout the Rand is about to be abolished, at least as far as the day's pay to European employees on the mines is concerned. A weekly payment in coin is to be substituted. The change will not affect the mine staffs or the contractors and other piecework hands. It is estimated that two-thirds of the white workers will be affected by the innovation. The new system which is just about to be introduced, is in response to one of the demands of the Federation of Trade Unions, a demand of so sweetly reasonable a nature that ready recognition has been accorded to it. In addition to the weekly cash settlement, the following kindly concessions are likely to be generally granted: When a company discharges a married man, who has a wife or family living with him, he can, by paying a month's rent in advance, secure undisturbed possession of the mine house that he occupies for the ensuing thirty days. Underground men on day's pay, in respect of whom no leave regulations are at present in force, will be entitled to ten days' leave annually on half-pay after one year's continuous service. Surface men on day's pay, not yet included in any leave scheme, will be granted ten days' leave annually on half-pay after two years' continuous service. No pay will be given in lieu of leave not taken, and leave shall not be cumulative. Regarding the change to weekly payments, it may be asserted confidently that the new method will prove an efficient antidote to the poisonous system of credit fostered by the old method, and that substantial benefits will thus accrue both to the workers and to the tradespeople who supply their wants. Under the present circumstances the retail merchant makes many bad debts, and, in self-defence, has to raise the price of his goods against the honest worker, a state of things that makes for increased cost

of living. Again, the miner who draws his earnings in one lump sum at the end of the month is apt to imagine that he is wealthier than he really is, and is tempted to indulge in an orgy of extravagance leading to subsequent financial embarrassment. In any case, 52 monetary pulsations per annum are less trying to the average worker than 12 violent ones. Some initial inconvenience is certain to be caused by the adoption of the new custom, but in a few months everything should be

Sanitary Officer to the Panama Canal, to visit the Rand and to investigate local hygienic conditions and report thereon. This invitation is largely the result of the visit of Mr. Samuel Evans to the Isthmus of Panama at the end of last year, an instance of a holiday spent to better advantage than is the stereotyped scamper to England and back. That it should be thought necessary to import an adviser in such matters would seem to point to a moderate amount of knowledge on the



THE NATIVE WORKERS OF THE RAND.

running quite smoothly. The annual leave allowance is a big step forward towards happier conditions, for if anyone requires a change it is the miner who works on the monotonous, dusty, unlovely Rand gold mine. It is surprising how a week's dallying with the silver sea will enliven the mind and make life seem better worth living. Moreover, the steady stream of travel from the hinterland to the coast, which will ensue, will certainly have its effect on the opening up of the sub-continent.

Sanitation.—The recognition of the fact that sanitary and general health conditions are unsatisfactory, has led the Chamber of Mines to invite Colonel W. C. Gorgas, Chief

part of the local medicos on matters of hygiene. In his instructions to his canal staff, Colonel Gorgas writes: "It is the policy of this office to give district sanitary inspectors wide latitude in the administration of their districts and the management of all affairs pertaining thereto. They will at all times have the support and full backing of this office in the faithful performance of their duties. Their recommendations and suggestions are sought, and will receive careful consideration." Rand financiers, consulting engineers, and mine managers might well ponder over this notice and apply the spirit of it to local affairs.

The Annual Report of the Mines Depart-

ment for the year 1912 is a comprehensive, workmanlike, and highly interesting volume, one that should be carefully studied by all connected with the mineral development of the Union. A few selected facts and opinions may be commented upon. The opening of the Selati railway through the Murchison range has made little difference, because the district is still afflicted with malaria, metallurgical problems, and scarcity of water. The alluvial diamond diggings at Bloemhof and Barkly West attract a mixed vagrant population, with the result that children, the hope of the Union, are bred in an atmosphere of dust, heat, liquor, and hardship in pretty equal proportions. Here is a splendid field for missionary enterprise. Unfortunately the churches have done next to nothing, being too busy with religion to have much time to devote to humanity. No class of men, except sailors, can equal the alluvial diggers for readiness to help a comrade in distress, and it is a great pity that such demoralizing conditions should obtain. 5000 white men and 14,000 coloured are directly employed, and in 1912 the diggings produced 182,241 carats, valued at £991,299. An interesting feature of the Namaqualand copper industry is the long period during which miners, both white and coloured, have lived and worked on their present mines. Coloured youngsters have grown to middle age without change of employment, and Cornishmen and others have to ask the mine captain whether it was 29 or 30 years ago when they first came to Namaqualand. Accidents are rare. The Dundee coalfield in Natal has two coal seams. The top seam is from 3 to 4 ft. thick with a sandstone parting, 3 to 6 ft. thick, separating it from the bottom seam, which is 5 ft. 6 in. thick. The practice is to mine only the bottom seam, although the top seam is equally good, as the difficulties of working the two seams together are too great for Natal mining talent. Such a shockingly wasteful method would never be permitted in Europe. Natal produced 2,760,000 tons of coal in 1912 as against the Transvaal's 4,750,000. On the Rand gold mines the ratio of coloured to white workers was 8'1:1; 0'90 white and 7'34 coloured persons were employed per 1000 tons crushed; 1,106'1 tons per white and 136'3 tons per coloured person were crushed. In December there were at work underground 111 whites and 1362 coloured per 1000 tons hoisted per day; and for 59 producing and 7 developing mines there were employed in December 23,418 whites and 193,974 coloured. The accident death-rate in the Transvaal per 1000 employees was

3'56 as against 3'76 in 1911. The three factors mainly responsible for the continued high death-rate are, bad health conditions, speeding-up to secure large outputs, and anxiety to reduce working costs. There is a wealth of other statistical data in this commendable publication, and, among other things, all the questions set at the various examinations for certificates for competency are included. A perusal of these questions will act as a corrective to anyone who is vain of his mining knowledge.

The Inaugural Address of the President of the South African Institution of Engineers, Mr. W. Calder, contains no ideas of a revolutionary complexion. He advocates the placing of electrically-driven air-compressors at the bottom of downcast shafts, and suggests ventilating districts in the mine each with its own compressor drawing its air from the main air-intakes. He advances a strong plea for underground sorting in view of the support afforded by packed waste, the reduction in the timber bill, and the relieving of the haulage-shafts of from 10 to 20% of their work. He refers to the success attending the use of the internal-combustion engine in underground haulage on main transfer-levels, to the great benefit derived from the practice of neutralizing the acidity in the mine-water before pumping it to the surface, to the passing of the reciprocating steam-engine on this field as a prime mover, and to the general electrification of mining-plant.

The Government Training School for miners has been doing its best for the youth of the country for two years with but indifferent success. In the report of Mr. W. Moses, chairman of the Board of Control, covering the first 18 months, three reasons are given for this comparative failure. They are (a) the miners' phthisis scare; (b) dislike of hard work; (c) impatience of control and of the indenture period of three years. The school failed to attract the young men of the poor white class, for whose benefit it was designed, and recruits had to be drawn from a much more limited description. During the period covered by the report 107 apprentices signed their indentures. Of these, 26 resigned at the end of three months' probation; 8 resigned to take up better positions; 7 resigned as medically unfit; 20 were dismissed for misconduct or as unsatisfactory; and 46 remained in residence. An apprentice on joining the school begins with such simple work as shovelling, tramping, carrying drills, &c. He then goes on to hand-drilling, and after that to machine-work. After a year's work altogether, if he

is a reliable worker, he receives his blasting certificate and is drafted to a neighbouring mine, where he obtains wider experience in timbering and other general mine-work. He receives 4s. 3d. per shift at the very commencement, and this with free quarters and cheap board enables him to be self-supporting from the beginning. Bonuses are given for steady work; and the industrious learner can every month show a surplus of from £4 to £5 after paying all running expenses. The school offers a splendid chance to the poor, but ambitious, youth to rise in the world. The practical training is excellent, and at the evening classes the more theoretical aspects of mine-work can be studied. When thus equipped with both theory and practice there is nothing to prevent the student from developing into something approaching a mining engineer. But the young South African is prone to take the short cut in mining, which lands him in the blind-alley occupation of packing waste at 10s. per shift, instead of following the path of lower initial pay but vastly superior ultimate chances. The school is deserving of every encouragement, and it is regrettable that the financial position showed a net loss of £3624 or £307 per month.

Electric blasting is receiving a great deal of attention at the present time. The investigations of the Miners' Phthisis Prevention Committee have conclusively proved that the very fine dust created by blasting operations is one of the chief causes of a disease that is almost a national calamity, and that it is, therefore, highly desirable for as few persons as possible to be down in the mine when blasting takes place. Such a remedial modification of the present routine would be difficult to bring about otherwise than by the aid of electricity, and experiments are now being vigorously conducted, on a working scale, to ascertain if so sweeping a change of method is practicable. The Corner House has been trying the system on some of their mines, and the General Mining & Finance Corporation has, on the advice of the management, decided to introduce it throughout in the Meyer & Charlton mine. One of the objections brought forward against electric blasting is that the simultaneous firing of a number of holes would cause sufficient vibration to loosen the hanging wall, but this difficulty is easily overcome by the use of delay fuses, which, while fired electrically, burn for differing intervals of time. As regards immunity from accident, there is, according to German statistics, little to choose between fuse and electric firing, so that in the case of the

Rand the all-decisive reason for the introduction of electric blasting is the vital necessity of fighting the graveyard-filling phthisis.

The Swaziland Tin made a working profit of £24,809 for the year ended June 30, 1913, which compares favourably with the working profit, £8710, made in the previous year, and paid a dividend of 25% on its capital of £82,000, carrying forward a balance of £6162. 408,000 cubic yards of tin-bearing alluvial was sluiced, at a total cost of 11s. 7d. per yard, yielding an average return of 2s. 2'2d., and a profit of 1s. 2'5d. per yard. This cost includes all expenditure. The actual cost of mining, sluicing, and recovering the concentrate was 6'75d. per yard. A reserve of 2,000,000 cubic yards averaging 1'5 lb. metallic tin per yard was proved by 1235 bore-holes of a total footage of 15,831, and 10,000,000 more cubic yards of tin-bearing alluvial of unascertained value is in the neighbourhood of the present workings. During the year a hydro-electric plant was installed for generating current for operating the new gravel-pumps, but considerable trouble has been caused by interruptions to current and by the pumps and pipe-lines. These difficulties, incidental to most new plants, are gradually being overcome. Generally, the prospects of the concern are good, provided the price of tin remains steady.

CAMBORNE.

Geevor Tin Mines.—It is announced that the development of the Pig North and South lodes continues to open up well, and that it has been decided to sink the main shaft another 150 ft. For the five months ended August 20, the mill crushed 12,009 tons of ore, which yielded tin concentrate selling for £16,430. These figures indicate the recovery to be 27s. 4d. per ton, and in view of the further statement that the monthly profit averages £1000, the working cost must be about 19s. per ton, seeing that £1000 per month equals 8s. 4d. per ton profit. The mill is to be extended to a capacity of 200 tons per day, and four pneumatic stamps have been purchased, of which two will be installed at once. It has been decided to form a separate company to work a portion of the large undeveloped area.

East Pool & Agar.—Although these mines are now being vigorously developed, like Carn Brea, no bunch has yet been found. For the four months ended August, the tonnage handled was 23,275, the average recovery of tin and wolfram being 18 lb. per ton and the total selling price £22,056. The development footage for this period was 1295 ft., or one foot for

every 18 tons crushed. It is unlikely, considering the increased development, that the working cost is under £1 per ton, so it is evident that losses are being made. Better supervision underground is now the order of the day, and this, coupled with the gradual substitution of machine-drills for hand-labour in stoping, should reduce costs in the future. The new electrically-driven compressor, made by Holman Brothers, is working well, and it will be interesting to hear how the cost per unit compares with steam-driven compressors. This compressor is equipped with an automatic starter, which so far as I am aware is a novelty in Cornwall.

Basset Mines.—There has been a substantial improvement within the past few weeks, the flat lode in the bottom of Pascoe's shaft having greatly improved in content. This shaft is being sunk below the 320-fm. level, and it looks as though at last the poor bar of ground in the bottom of the mine has been left behind. The sales have been increased to 50 tons per four weeks, and for the nine months to September 29, according to the ticketing record, the sales amounted to 416 tons worth £51,814, which compares with 348 tons, worth £45,847, for the same period last year. But for an £8 drop in the average price, the financial result would have been substantially better. For the four weeks ended September 10, the yield was 28 lb. per ton, as against 25.5 lb. for the whole of 1912, and the profit earned was £686, or 3s. 3d. per ton.

It has been decided to erect an additional pumping engine at Marriott's shaft and to instal another lift. The Chairman at the last shareholders' meeting referred to the difficulties experienced in keeping the water out of the bottom levels, and he then warned his hearers that if the developments in the bottom of the mine were to be continued, additional plant would be necessary. The inflow of water at Basset is very heavy and with an output of only 4000 tons per month, pumping charges are higher than at any other mine in the county.

Botallack.—It is satisfactory to record that the grade of the ore milled shows a steady improvement. For the four weeks ended September 20, the battery crushed 1669 tons of ore, while the sale of black tin, amounting to 15 tons, realized £1686. This gives a recovery of 20 lb. per ton, which is a decided increase on previous monthly figures. For the nine months ended September 29, 110½ tons of black tin was sold at the ticketing, realizing £13,877. For the same period last year, the figures were 80½ tons and £10,203. As cap-

ital was necessary to provide additional crushing machinery and for the general purposes of the company, an issue of £10,000 6% debentures has been arranged. These debentures will rank as a first charge on the property and assets of the company, over-riding the existing debentures.

Basset & Grylls.—The cross-cut at the 60-fm. level has intersected the Old Men's lode, which shows profitable ore for the limited distance so far driven. The cross-cut is to be extended with the object of striking the old Wheal Cock lode, which was fairly rich in the old workings, according to the records available. The Wheal Cock and Old Men's lodes join at a depth of about 30 fm. below the present workings. The mine is under the direction of E. S. King, who is well impressed with the developments to date.

The Clay-Workers' Strike continues, but the men are gradually going back to the pits, and it is evident that, as anticipated in my August letter, the masters on this occasion will win. The strikers are now getting desperate, and there have been several unfortunate collisions with the police. Relief funds are being raised in the district for the purpose of assisting the families of the strikers.

Ticketing Regulations.—No progress has been made at the conference between the smelters and the representatives of the mines, convened for the purpose of improving the conditions of the sale of black tin at the ticketings. It is no secret that the smelters were prepared to purchase on dry weight, but the possible loss of the tin left in the sacks after delivery proved a stumbling-block with some of the mine representatives.

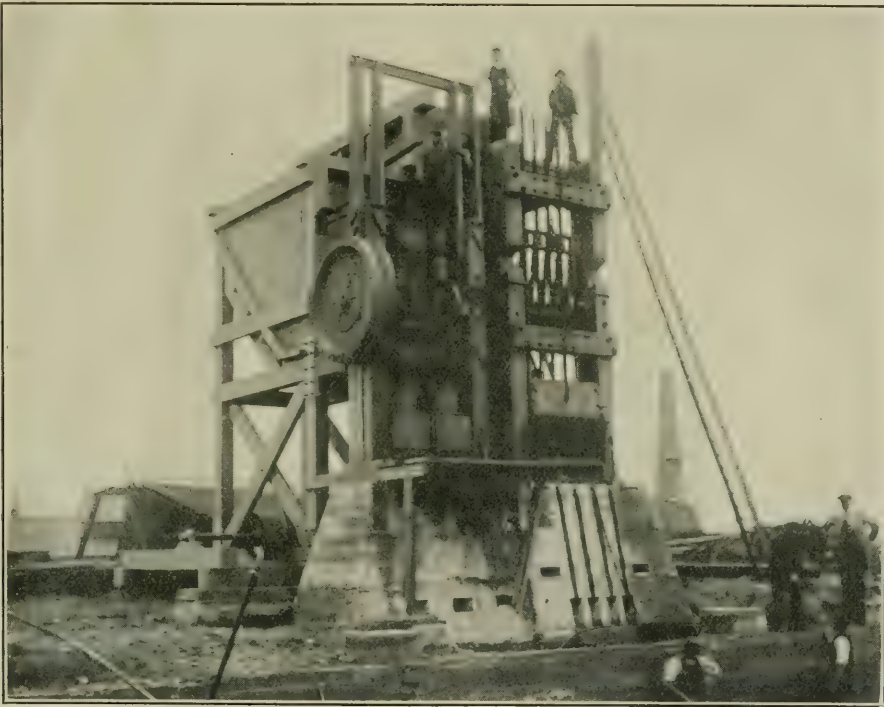
Great Dowgas.—The sale of the plant and machinery which took place recently is the last chapter of this unfortunate venture. I say unfortunate, because the property has not been adequately developed to prove anything definite, while on the other hand, thousands of pounds was spent on surface machinery and dressing plant before the position of the mine warranted it. Formed in July 1905, the company had a nominal capital of £60,000, which was subsequently increased to £90,000, and ample working capital was provided. The property adjoins the Great Hewas, Great Polgooth, St Austell Consols, and other famous mines, which collectively yielded ores of tin, copper, etc., to the value of over 2½ million pounds. The mistake was made of spending the greater portion of the working capital on machinery instead of on development, a blunder made so often.

Grenville United.—In my letter last month, the cost per ton for royalties was given as 2s. 2½d. whereas it should have been 1s. higher, or 3s. 3½d. per ton.

Carn Brea & Tincroft.—The attention of the mining community in Cornwall is directed to the competition which has been arranged by E. S. King for the purpose of guiding him as to which form of stamp to instal in the new crushing plant to be provided out of money lent to the company by Viscount Clifden. The trial is between the Californian

this favourable result. The authorities at Tresavean have given an order for three Nissen stamps. An order has also been given for two Nissen stamps for the Garlidna mine in the Wendron district, on the recommendation of Josiah Paull, the manager of South Crofty.

The product of the respective trial batteries will be treated over Card tables, supplied by N. Guthridge, of London, while the middling will be re-ground in Cobbe-Middleton grinding pans. From these, the pulp flows over more Card tables and the middling is again



NISSEN AND CALIFORNIAN STAMPS SIDE BY SIDE AT CARN BREA.

stamp, supplied by the Sandycroft company, and the Nissen stamp manufactured by Head, Wrightson & Co. The battery of five Californian stamps, although erected, is not yet ready for a trial run, but the two Nissen stamps have been installed and private trials have been made. In trials between the Nissen stamp and the plant at South Crofty, the former proved that in spite of its greater weight it produced less slime. The South Crofty stamps produced 39% of minus 200-mesh, and the Nissen only 33%. The greater rapidity of discharge by the Nissen stamps accounts for

re-ground. I am given to understand that excellent results have been secured on this combination, which contains several features new to Cornwall.

The loss for the four weeks ended August 23 was £2283, or only about £500 short of the total loss for the six months ended June 30 last. On account of the lack of capital, the position is causing anxiety locally, and the report on the property now being made by James Bros. is awaited with interest, for no doubt on this will largely depend the provision of further capital.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Sept. 1913	August 1913	Sept. 1912
£73. 5s. 3d.	£69. 6s. 0d.	£78. 17s. 5d.

The strong statistical position of this metal is growing still stronger. While American stocks are diminishing and American shipments to Europe are continuing at their high level, the European stocks at each compilation show steady diminution. So marked is the contrast between the figures published and the persistent reports of declining trade that the financial Press is now commencing to discredit the accuracy of the published returns, and in one quarter to account for the shortage by the fact that producers are holding back supplies at the mines. While these statements are serving a useful purpose in restraining any wild speculative movement, consumers would be well advised to keep a level book, and not be tempted to go short of supplies. The position in regard to supplies is more critical than is recognized by those not in close touch with both consumers and producers. The rapid rise of the past two months confessedly lends colour to the suggestion of manipulation, but direct evidence is lacking. The general position in the United States, where legislative activities combined with fears of labour troubles and disappointment over the harvest engender a wholesome restraint, has discouraged plunging by bull operators, and the best interests of the copper trade will be served by a continuance of this restraint.

TIN.

Average prices of cash standard tin :

Sept. 1913	August 1913	Sept. 1912
£193. 7s. 7d.	£188. 19s. 0d.	£223. 19s. 6d.

The market has drifted into dulness, and the various movements in prices give little indication of any broad general tendency or of any fixed policy on the part of operators. At the Banca sale the metal fetched an average of £193. 10s., but the hopes of a rising market have been dissipated by the unexpected increase of 1832 tons in the visible supplies at the end of September. Eastern sellers have been parting with their product at falling prices, and the American demand is not encouraging. Traders hope for better business after the passage of the new tariff law. Trade in this country is steady.

LEAD.

Average prices of soft foreign lead :

Sept. 1913	August 1913	Sept. 1912
£19. 14s. 10d.	£19. 15s. 8d.	£21. 9s. 0d.

Lead has been marked by short spasms of depression. The period of high prices has lasted so long that bears have been tempted to sell short. With restricted supplies they have, when forced to cover, driven prices up again to their own undoing, and to the continued support of the market. Russia has been and still remains a heavy buyer, laying in a winter supply, but in this country manufacturers complain of bad trade. It is probably this consideration that has led them to work on insufficient stocks, whereby they have been forced into buying for immediate delivery at heavy premiums. Dealers are thought to be still on the short side for both September and October delivery. There is little change in the Mexican situation. Some smelters are working fitfully, but as we go to press news reaches us of the capture of Torreon by the rebels, cutting off supplies from there, and also from Mapimi.

SPELTER.

Average prices of good ordinary brands :

Sept. 1913	August 1913	Sept. 1912
£21. 3s. 10d.	£20. 14s. 0d.	£26. 17s. 0d.

Prices suffered a relapse when dealers heard that the syndicate had not raised its selling limit, and quotations on the London market fell to £20. 15s. to £21 for ordinary brands. Consumers are covered well ahead, and business is dull. Dealers who had bought freely last month in anticipation of higher markets have been forced to put about 2000 tons into London warehouse. This will effectually check any upward tendency for some time.

OTHER METALS AND MINERALS.

Prices quoted on October 10 :

SILVER.—28½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £87 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£28 to £30 per ton.

QUICKSILVER.—£7. 5s. per flask.

MANGANESE ORE.—9½d. to 11½d. per unit.

IRON ORE.—Cumberland hematite 23s. per ton at mine. Spanish 20s. delivered.

PIG IRON.—Cleveland 53s. per ton. Hematite 65s. 6d. per ton.

WOLFRAM ORE.—33s. per unit (1%).

PERSONAL

G. PERCY ASHMORE is home from Newfoundland.

J. A. AGNEW, formerly with Bewick, Moreing & Co. in Australia, is now at Lima, Peru.

J. F. BALFOUR has returned from Northern Nigeria.

S. H. BALL sailed for New York on Oct. 18.

NOEL BARBER has returned from Mexico.

A. CHESTER BEATTY sailed for New York on October 4.

E. J. BORLASE has left Rio Tinto to become chief engineer with the Huelva Copper & Sulphur Company.

THOMAS BREAKELL has gone to Asia Minor.

WALTER BROADBRIDGE, chief engineer to the Minerals Separation Company, has gone to Chile.

W. A. CARLYLE sailed for South Africa on September 20.

E. J. CARLYLE, on his return from the Argentine, sailed for New York on October 11.

PERCY CAZALET is here on leave from Johannesburg.

CAMILLO CERRUTI, formerly at Johannesburg, was in London recently.

GEORGE P. CHAPLIN, of Bruce Marriott & Co., has returned from a tour in Australasia.

F. CLOSE has started consulting practice in conjunction with G. T. Holloway & Co., at Limehouse.

CECIL H. CROPPER has been appointed assistant-manager of the Tronoh mine, in the Malay States.

A. M. FINLAYSON sailed for Burma on October 9.

F. LYNWOOD GARRISON is in California.

THEODOR GOLDSCHMIDT is studying metallurgical improvements in America.

W. H. GOODCHILD is home again from the Transvaal.

CHARLES GREENWAY, metallurgist to the Cordoba Copper Co., has returned to Spain.

W. J. HAMILTON has been appointed general manager of the Cerro de Pasco.

PAUL HEROULT is visiting the United States.

RUSH M. HESS is returning from Colorado to Ecuador.

THOMAS HUNTINGTON is visiting the Bwana M'Kubwa copper mine, Northern Rhodesia.

J. POWER HUTCHINS was married to Miss Elizabeth McNear in London on October 15.

A. E. KITSON has been appointed director of the Geological Survey of the Gold Coast.

HENRY C. JENKINS has returned from Nigeria.

CARLOS W. VAN LAW, from Pachuca, has been in London and Paris.

ERNST LICHTENBERG sailed for Canada on October 3.

EDWARD LORING was married in London on September 11 to Miss Vera Birkbeck.

HAROLD D. MARTIN has returned from Siberia.

H. F. MARRIOTT left for Prestea, West Africa, on September 26.

JAMES NEGUS left on October 2 on his return to the Mount Boppy mine, N.S.W.

H. NESTOR SCHNURMANN has legally adopted the name of Nestor Sherman. He leaves for Bengal shortly.

K. C. NICHOLS has returned from the Kamerun, whither he went for the Niger Company.

MUNGO PARK is here from the Malay States.

WALTER G. PERKINS is on his way to Korea, by way of Siberia.

ROBERT P. ROBERTS, of Great Falls, Montana, has been appointed metallurgist to the Mount Lyell company in succession to A. L. Dean.

C. G. RUTLEDGE has been appointed manager of the Mammoth copper mine, Chillingoe, Queensland.

EDWARD R. SCHOCH has left London on his return to the Rooiberg tin mine in the Transvaal.

A. E. SEAL has returned from Colombia.

STANLEY C. SEARS was married on October 8 at Salt Lake to Mrs. Robert Holmes Officer.

S. A. R. SKERTCHLEY has returned from Spain, and will probably go to Mexico.

G. HILDICK SMITH is on his return journey to the Rand.

R. E. SMITH has been engaged as chief technical assistant to Leon Perret, general manager for the Lenskoie Gold Mining Company.

O. J. STEINHART, of Twite & Steinhart, was in Portugal during September.

H. L. TWITE has gone to the Mawchi tin mines in the Southern Shan States.

ERNEST WILLIAMS has returned from Russia.

L. WILMOTH is on his way to Korea.

HORACE V. WINCHELL, on his return from the Argentine, visited San Francisco.

ERNEST R. WOAKES, accompanied by LAUNCELOT DAWSON, has gone to Asia Minor.

POWER ON MINES.

Timely notes on Production of Gas from Wood. Items of Cost.

By W. J. LORING

THE all-important problem of cheapening the cost of power-production has had, for many years past, the serious consideration of my firm. It was recognized that power costs in Western Australia were then, and would no doubt continue to be, on the extravagant side, solely on account of local conditions, namely:

1. High cost of fuel.
2. High cost and poor quality of water for steaming. This does not apply to the Coolgardie water scheme, as that water is excellent, but expensive.
3. High cost of boiler-cleaning, and of spare parts.

However, these three problems have had our serious attention, and good progress has been made toward a material reduction in the cost of producing power. The improvements have been in the direction of substituting gas as a motive-power in the place of steam. The use of gas for producing power is not new, but the application of gas-power generated from wood direct, running continuously, without trouble, at 40% less cost than the best steam-plants, is, I think, worthy of publicity.

For some years we have been using gas-power generated from charcoal, with satisfactory results, comparing its cost with that of producing steam. Inventions for the production of gas direct from wood have been on the market, but unfortunately the trials were not as satisfactory as we could wish. Certain alterations were made by our mechanical engineering staff, which have resulted in a great improvement.

Under our management in Western Australia the following plant has been operated for comparative results, which I am pleased to give:

- One 20-stamp mill; stamps of 1250 lb. each.
- One 15 by 9 in. Blake rock-breaker, with elevator.
- One 16 ft. by 4 ft. tube-mill.
- One 5 ft. grinding-pan.
- One tailing-pump.

A complete sliming-plant, including a vacuum-filter, B. M. thickener, agitators, and the usual pumps, elevators, etc.

A charcoal producer was installed to generate gas, and in September 1912 the producer ran 30 days, using 50 tons of charcoal, valued at £156. 4s. 3d., or a cost of £5. 4s. 1d. per 24 hours.

In October 1912 the producer ran 31 days, using 53 tons of charcoal, valued at £159. 3s. 0d., or a cost of £5. 2s. 8d. per 24 hours.

In November 1912 the producer ran 11 days, using 20 tons of charcoal, valued at £60, or a cost of £5. 9s. 1d. per 24 hours.

Wood was then substituted for charcoal, and the producer ran 19 days, using 50 tons of mulga fire-wood, valued at £37. 10s. 6d., or a cost of £1. 19s. 6d. per 24 hours.

In December 1912 the charcoal producer ran 11 days, using 22½ tons of charcoal, valued at £67. 13s. 1d., or a cost of £6. 3s. 0d. per 24 hours. The wood producer ran 18 days, using 53 tons of fire-wood, at a total value of £40. 16s. 10d., or a cost of £2. 5s. 5d. per 24 hours.

In January 1913 the charcoal producer ran 9 days, using 15 tons of charcoal, valued at £45, or a cost of £5 per 24 hours. The wood producer ran 19 days, using 61 tons of fire-wood, at a total cost of £47. 6s. 9d., or a cost of £2. 9s. 10d. per 24 hours.

In February 1913 the charcoal producer ran 10 days, using 17 tons of charcoal, valued at £56. 12s. 0d., or a cost of £5. 3s. 2d. per 24 hours. The wood producer ran 18 days, using 45 tons of fire-wood, valued at £33. 15s. 0d., or a cost of £1. 17s. 6d. per 24 hours.

In March 1913 the wood producer ran 31 days, using 99 tons of fire-wood, valued at £74. 5s. 0d., or a cost of £2. 7s. 10d. per 24 hours.

Comparing the month of October 1912, when the charcoal producer ran 31 days, with the month of March 1913, when the wood producer ran a similar period, the following interesting figures are shown: A saving by the use of wood over charcoal of £2. 14s. 10d. per 24 hours, and 3'64d. per ton crushed.

Date	Tons crushed	Days run	Total cost	Cost per 24 hours	Per ton crushed
Oct. 1912	5500	31	£159. 3s. 0d.	£5. 2s. 8d.	6'94d.
Mar. 1913	5400	31	£74. 5s. 0d.	£2. 7s. 10d.	3'3d.

The above is a comparison of fuel cost in

running a gas-engine of 200 b.h.p. at sea-level, generating an average of 170 b.h.p. where now in use on the goldfields of Western Australia.

The October run is with the engine coupled to the charcoal gas-producing plant, the cost of charcoal being 59s. per ton.

The March run is with the engine coupled to a continuous wood gas-producer plant, of the Degenhardt-Jorden type, the cost of wood being 9s. per ton, delivered on the mine in 6-ft. lengths, or 15s. per ton cut in 2½-ft. lengths, and delivered on the producer platform. In both cases the cost of fuel is calculated on the basis of delivery on the producer platform.

This generator may be used on any wood and coal. Wood is used in 2 to 2½ ft. lengths, 6 to 12 in. diam., or in odd pieces, such as scraps from timber-framing and carpenter work. Hollow logs may be used. Any sand or clinking matter introduced unavoidably with the fuel is easily eliminated by the special grate invented by our chief mechanical engineer, Mr. W. R. Degenhardt.

In using wood, actual practice has demonstrated that from 2 to 2'2 lb. of mulga wood are required per b.h.p.-hour. Stoking is easily carried out, while the admission of air during stoking is of no consequence; the covers on the producer are loose and easily handled.

A short description of the operation of this generator and the result therefrom will be of interest. The ordinary producer plant, using charcoal or coal, is so arranged that air and steam are drawn through the fire-grate, and maintain combustion of the fuel sufficiently to distil and enrich the explosive gases which pass up through the fresh fuels. These gases, of course, contain volatile matter (tar) which must be removed before the gases are pure enough for use in an engine.

Bituminous coals and ordinary fire-wood contain, respectively, 30% and 60% of volatile matter, and in the ordinary producer tar-extractors are necessary for its removal. Good charcoal contains only a small amount of volatile matter, and the usual coke and sawdust scrubbers are sufficient for its removal. In the case of bituminous coals, the large quantity of volatile matter rejected represents lost energy. In the case of charcoal, its manufacture by burning in kilns drives off this volatile matter, but the gross loss of energy is the same.

The work that the continuous wood or coal gas generator does is to convert into a fixed gas for engine use, not only the fixed carbon in the fuels, but the volatile hydrocarbons,

and to get the maximum heat energy out of the crude fuel. This continuous generator is of the down-draught type, that is, the air and superheated steam necessary for the combustion of the fuel and enrichment of the gas pass down through the fuel in the course of combustion, where they combine with the carbon in the fuel, to form gas.

This short description will be sufficient to show how gas is being generated in this type of generator. The special feature in the Degenhardt-Jorden generator is the form of grate used, which admits of the fire-bars being sliced and raked while the generator is in operation. This prolongs the life of the fire-bars, and makes it possible to keep an even filter-bed of 'live' charcoal on the grate. From practical tests it has been found that it requires from 2 to 2'2 lb. wood per b.h.p.-hour.

Some comparisons follow: Firewood costing 13s. 6d. per ton used for steam generation, and developing power by means of a compound-condensing steam-engine (steam consumption 15 lb. per b.h.p.-hour.); the cost of fuel is 0'36d. per b.h.p.-hour.

Charcoal costing 65s. per ton, and used in a producer-gas plant, driving a gas engine; the cost of fuel is 0'348d. per b.h.p.-hour.

Fire-wood costing 13s. 6d. per ton, plus 4s. per ton for cutting into 2-ft. lengths, and stacking on generator platform, making the cost 17s. 6d. per ton at point of use. The above used in a Degenhardt-Jorden continuous gas-producer, driving a gas-engine, the cost of fuel is 0'198d. per b.h.p.-hour.

Collie coal, costing 34s. per ton, and used in the same gas-producer and engine; the cost of fuel is 0'18d. per b.h.p.-hour.

Our chief engineer is well versed in gas production, having been employed by a large concern using gas in Australia, prior to entering our service. His knowledge, coupled with the experience and knowledge of our staff and the combination of collective forces, has resulted as above. So much do we think of this advance in the production of cheap power that we are at present installing a gas plant on the Sons of Gwalia at Leonora, Western Australia, to generate 660 h.p., the redemption of the cost of same being made in 36 months. Therefore, a mine having a reserve of ore equal to a supply for over 36 months will do well seriously to consider substituting this type of power for the usual steam-plants, especially in a country where the fuel-supply is getting depleted within an economical distance of the point of consumption, which, at the present rate is certain to increase the price.

TRAVELLING IN RUSSIA

By JOHN POWER HUTCHINS

Introductory.—The important gold mines of the Russian empire are situated in regions having a hot summer and a cold winter, the temperature ranging from over 90° F. in summer to *minus* 50° F. in winter ; therefore there is a great difference between the outfit needed in varying seasons. Owing to tales often more picturesque than veracious, we are apt to think of Siberia as a frozen waste, teeming with fierce wolves and dangerous bears. However, the summer climate is warm and delightful. Large crops of oats and other hardy grains are harvested even on the watersheds of the Lena and Amur rivers. Wild flowers are plentiful. Several varieties of wild berries grow abundantly. It is necessary that these circumstances of climate should be appreciated in order to prepare for travel in the Russian empire.

The illustrations accompanying this article are intended to show the unusual modes of travel and transport.

There is an increased interest in Russian and Siberian mining. Inasmuch as many engineers will be sent to this part of the world to examine mines, and they will have to face difficulties due principally to unfamiliarity with the climate, language, customs, and local conditions, the following paper is written, after several years' experience in Russia and Siberia, with the hope that it may be useful to other professional men travelling in these regions.

Anyone entering, living in, or departing from Russia must have a passport. This must be procured from the government of the country of which the traveller is a citizen. Before entering Russia or Siberia, the passport must be *visé*, or endorsed, by a Russian consul at some principal city outside Russia. This allows him to enter the Russian empire. On arrival at the frontier, this passport is inspected, and, if all is found in order, there is no difficulty. If he has no passport, or neglects to have it *visé*, there is a likelihood of trouble and delay. It is best to have a passport *visé* on every visit to Russia or Siberia, and so insure against delay. When the traveller is accompanied by his wife, it is better to have a separate passport for each person, for then each can travel separately, but one passport can be had that is good for husband, wife, and family. On arrival at a hotel, demand is generally immediately made for the passport. After residing

six months in Russia or Siberia it is necessary to get another passport from the Russian authorities. While in Russia and Siberia, the passport should always be kept where it can be quickly shown, for the officials may ask to see it. In some parts of Siberia request is seldom made to see the passport, and there seems to be a decreasing rigour in this respect. Before leaving the country, the passport must be *visé*. This is done by the police and is a matter of no difficulty ; it must not be forgotten, however. For instance, it may happen that owing to a hasty decision to leave the country, no time is available to have the passport *visé*, but if this has been done previously, it is then possible to start for the frontier, after arranging with the hotel-keeper to see the local police and telegraph the police at the frontier the necessary permission to leave the country.

In the larger cities the hotels are comfortable and generally have servants who can talk some other language than Russian. The hotels usually send an agent, or porter, to meet trains or steamers. These men attend to the registered luggage. They also help in departing, by buying the tickets, registering luggage, and seeing the traveller safely on the train or steamer. In hiring a *droshka*, an open carriage, and the usual means of conveyance in the city or town, a price should be arranged beforehand, and this can often be made for about half that first asked by the driver. This may save disagreeable argument in the event of the driver attempting to overcharge after arrival at the destination.

Language.—It is advisable to buy an elementary Russian grammar, and learn the printed alphabet before reaching Russia. It is advantageous, also, to learn the written alphabet ; also to count, and to ask a few necessary questions. For this purpose it is wise to take 'The American in Russia' or 'The Englishman in Russia,' paper pamphlets costing about 2 shillings or 50 cents, and containing a number of necessary and useful expressions, their equivalent pronunciations in English, and their meanings.

Strenuous efforts should be made to learn Russian, for it is a great advantage to know even a little of it. It is an extremely difficult language, but by diligence it is possible to learn a great many useful words and expressions in

a few lessons. It is a good plan to take even as few as five lessons as a preliminary to further study, if there is no time for more, at the Berlitz schools, which have branches in many



Tandem and Sleigh.

cities. I took a course of thirty lessons in a Berlitz school, and found them worth while. The most rapid progress, however, was made during the first ten lessons, when merely learning vocabulary and expressions. After that, it was attempted to teach grammar, and it is a tremendous strain to try to learn a difficult grammar like that of the Russian language when explained solely by gesticulations; it is discouraging and tiring as well. Good teachers of Russian can be found in the larger Russian cities. These can teach the grammar, explaining its difficulties in the student's own language, and it is easier, better, and cheaper than when going to the Berlitz or similar schools. Such teachers can be had for about 2 to 4 shillings per hour.

On going first to Russia, it is usually necessary to have an interpreter, unless you know German or French. Most educated Russians talk German and French, and many talk English, for Russian linguistically is very small, like Sweden or Norway, and Russians realize the need of studying foreign languages. In the smaller places, however, only Russian is probably spoken. It is exceedingly difficult to get a good interpreter. Linguistic facility generally seems combined with characteristics that make good barbers or waiters only. Therefore, the traveller is hampered by the interpreter not interpreting, but often finding out his ideas, taking up the business, talking it over with the Russian, settling it, and then telling the arrangements he has made. Interpreters can be hired for about £20 per month, and

expenses. It is recommended to hire, as an interpreter, a Russian who has been for some years in London, New York, or other foreign big city. Such a man is more likely to give satisfaction than one hired in Russia. The best way to avoid the troubles incidental to unsatisfactory interpreters is, of course, to learn Russian, and here again I urge the advisability of studying it.

As an instance of difficulty with interpreters, a well known engineer during the past few months found that his interpreter was asking for, and getting, commissions on purchases of outfit and supplies; also he was maliciously stirring up trouble among the labourers. Further, the engineer concluded that his interpreter was keeping the Russian vendors informed of what was going on, and it seemed that these latter might have been paying for such information. It is best not to put your faith in interpreters.

Customs and duties.—The Customs officials are like those of other countries. As a rule, they give little or no trouble, although usually they insist upon all packages being opened. They will confiscate playing cards



A Troika.

and fire-arms, and these had better be carried on the person if taken to Russia. After passing the Customs several times, it can be said that it is no more difficult in Russia than the

United States or England.* The Russian official does not usually ask you if you have anything dutiable, and, on receiving a negative answer, try to prove that you are a liar, by going through your luggage as often as do the American, German, or French officials, but, asking no questions, he proceeds to examine for himself.

Means of travel.—The principal mining regions of the Russian empire are in the Ural mountains, the Altai mountains, and on the watersheds of the Lena, Obi, Yenesei, and Amur rivers. These districts are generally reached by the Trans-Siberian railway or its branches, supplemented by travel on river-steamers part of the way. Usually it is necessary to do some travelling by wagon or sleigh as well. In winter, when the rivers are frozen and navigation is closed, it may be necessary to make long journeys by sleigh.

Railway travel is generally comfortable, though slow. When one is travelling alone, it is best to go first-class, but when two, or more, are together, it is often better to travel second-class. For instance, when two together buy first-class tickets, they are often put in one first-class compartment, usually having but two berths, and they will be crowded. When two travel together second-class, they are often put into a second-class compartment which is about twice as large as a first-class compartment and about the same in other respects. This is, therefore, much more comfortable. The trains are not generally crowded, so it is possible for two people to travel alone in a large second-class compartment. If the train is well filled, so as not to permit two people having a 4-place second-class compartment, it is then possible to change to first-class. The Compagnie Internationale des Wagons Lits runs sleeping and dining-cars on many of the Russian trains. It also runs a complete train on the Trans-Siberian railway from Moscow to Vladivostok. This train runs no faster than the other express trains, and there is no advantage in travelling upon it, advertisements to the contrary notwithstanding. The sleeping-cars are usually more crowded than are the Russian cars, and there is an extra charge for a service often not so good as on the Government or State cars. The Wagon Lits dining-cars serve bad *table-d'hôte* meals, which are best enjoyed by avoiding. The Government trains give both a *table d'hôte* and an *à la carte* service, which are both satisfactory.

It is well to remember that the traveller is

likely to be told at the Wagons Lits company's office that the Government cars are crowded, in order to make him purchase special tickets for the Wagons Lits cars, only to find that the ordinary cars are empty and that the Wagons Lits cars are crowded. It is only possible to change into the ordinary or State cars by paying full additional sleeping-car charges.

After several disagreeable experiences on Wagons Lits, I suggest that it is best to travel in the Government cars and on the Government trains by preference. I have made a long trip consuming nearly seven days on a Wagon Lit that was badly crowded, and very much out of repair, and so poorly lighted that it was impossible to read at night, and I was, as a result, not nearly so comfortable as passengers travelling second-class on the Government cars of the same train. I was told at the Wagons Lits office that the ordinary cars were crowded, when they were really almost empty. It is necessary to be particularly careful of the water from carafes in Wagons Lits. I have caught the car porter, who was drunk every day for the five days of the journey, filling a carafe with water from the car-tank while in Manchuria, instead of using only boiled water. This is the region that had been scourged by plague only a few months before, and where cholera and typhoid are common.

As a traveller is allowed only a small weight of free registered luggage, it is wise to have much of it in valises or bags, so as to be able to take these into the sleeping-car compartment. Large racks are provided for this purpose; and to illustrate, such impedimenta as palm-trees, dogs, cook-stoves, and cooking-utensils are sometimes seen in sleeping-car compartments on the cheaper trains.

When travelling in wheeled vehicles or sleighs, trunks even of steamer size are a great nuisance, and should never be taken. It is well to make it a rule never to take luggage on other than railway or steamer trips in Siberia in anything but small cases, bags, or valises, so as not to be inconvenienced or delayed. It is an excellent instance of the need for doing "as the Romans do."

Outfit.—Sheets, blankets, pillows, and pillow-slips are furnished on the principal trains, but, on the others, it is necessary to have these articles, as well as soap and towels. A rubber wash-basin, large enough to stand in, is a great convenience, and if travelling in winter and there is any desire for fresh air, it is well to have a screw-driver, for the windows are screwed tight on trains. Russians do not crave for fresh air.

* The writer is an American citizen, and therefore could not couple the customs inspection of these two countries.—[EDITOR].

Railway travel in Russia is not more costly than for similar travel in other countries. Second-class fares are generally about two-thirds those of first-class. Russians think it extravagant to travel first-class, and they marvel, and not without reason, at foreign com-

folding cot, as it often happens that all the cabins are occupied and the only accommodation is in the dining-room or elsewhere, on a bench or on the floor. It is wise to provide insect powder, for bed-bugs are common, not only on the steamers, but in many hotels in Siberia, and in nearly all peasants' huts. Extra beds are usually rare in Siberian houses, and these are usually so dirty that even the uncomfortable camp-cot is preferable. It is better to travel first-class on river steamers. Fares cost about $1\frac{1}{4}$ to $1\frac{1}{2}$ cents per kilometre on the Amur, and 2 to $2\frac{1}{2}$ c. per km. on the Lena. This does not include food, which costs about 4s. to 5s. per day.

On some of the steamers there are bath-rooms; it is wise, however, to have a rubber tub, which is also useful in the hotels, where bath-rooms are rare. As the Russian has a bath only about once per week, he does not object to going out to a bath-house. Thus, in Chita, a



Spike Team for Narrow Roads.

panies sending mechanics and labourers on first-class tickets.

On the Trans-Siberian railway, there are express and post trains. There are three express trains per week, each way. One of these leaves St. Petersburg, and the other two start from Moscow. The post trains run daily. Post trains have no dining-cars, and should be avoided for long trips across Siberia. The running time from St. Petersburg or Moscow to Vladivostok is 9 days by the express trains. The post trains take about 4 days more to complete the trip. It is usual to find someone on the trains, either among passengers or crew, who can talk English, German, or French, and there is little difficulty even for the American or Englishman, who is usually a poor linguist.

On rivers.—The steamers are generally comfortable, and the food is good. On them, as on some of the trains, it is necessary to have bedding, namely, pillows, blankets, and bed linen. In addition to the outfit required for travelling on trains, it is advisable to have a



A Springless Telegra.

city of some 60,000 people, the best hotel, which was built only in 1907, has no bath-room, although at Chita are stationed thousands of soldiers, and the hotel is, therefore, much patronized by generals and other officials of high degree, and by their wives.

It is only in the largest cities, where foreigners have been and have often complained of the lack of bath-rooms and the general dirt, that even second-class accommodation can be found. Even in St. Petersburg and Moscow, the best hotels are not first-class as compared with hotels in Berlin, Paris, or London.

On the upper reaches of rivers, where there is insufficient water for steamers, it is sometimes possible to travel in small boats. With each boat there are four men who are supposed to row or paddle when going with the current, and one man to steer. The rate of travel is supposed to be 10 kilometres per hour, if the men are not too lazy. When ascending the river, two horses are used to tow the boat; one man steers the boat and a man or woman rides each horse. Thus about 10 kilometres per hour can be made. The cost, where there are post-stations, is about $2\frac{1}{2}$ cents per horse per kilometre on the upper Lena, which is the same as for travelling on wheels or runners on roads in the same region, and $4\frac{1}{2}$ c. per km. when going down-stream. Prices are raised 50% in the early spring and late autumn. It is impossible to travel with fewer than two horses.

On roads.—It is often necessary to cover considerable distances by road. In summer this may be done in wheeled vehicles or on horseback. The wheeled vehicle generally has springs, made of wooden-poles arranged somewhat like a buckboard, but not so well, and very uncomfortable. Surprisingly rapid time can be made in some parts of Russia. I once made 20 miles over a good road in a few minutes more than two hours. Over 100 miles are often covered in 24 hours.

If there is expectation of doing much on horseback, it is wise to carry a good saddle. The Siberian saddle consists of a frame to which is strapped a straw-filled cushion. As this cushion must often be removed in unsaddling, it cannot be placed in the same position each day, and as a result new sore spots are being made, as if riding a saddle of different shape each day. After several weeks' riding in Siberia, I have been just as saddlesore as after the first night. Indeed, it is often impossible to stand the pain for more than 15 or 20 miles, and it is preferable to walk.

It may be necessary to drive long distances in winter when navigation is closed. This is very hard travelling, and it is dangerous as well. Post-houses are established along the principal arteries of travel, and horses and drivers are supplied. It may be necessary to make dreary waits in dirty, badly-ventilated

post-houses for horses. It is wise to procure a ticket, giving preferential rights to post-horses. This can be arranged by using the proper influence in St. Petersburg. It frequently happens that because of the post being sent, or expected, or for some other reason, you are told that there are no horses, and then you must either prove the station-keeper a liar, as he often is, or wait, or hire horses from some village. It is always more expensive to hire other horses, and it is extremely tiresome to bargain with peasants. They usually ask more than they hope to receive. It is well to bargain, for, if a traveller is too easily imposed upon, the good news is passed along from station to station, and prices keep rising progressively. It is inadvisable to tip unreasonably, for this leads to abuse also; the equivalent of 6 pence per stage of 20 to 25 kilometres is quite enough.

It is best, when starting on a long drive, to hire a vehicle for the whole journey; this saves shifting the luggage from vehicle to vehicle at the end of each stage. A good vehicle can be hired at the rate of about $2\frac{1}{2}$ cents per kilometre. It is often cheaper to buy a vehicle, when making trips of 500 km. or more, relying upon selling it at the end of the journey, or using it on the return trip. When hiring or purchasing, close inspection of running gear is needed to insure against breakdowns and delays. Care must be taken to avoid travelling on roads when the ice is forming, or when it is melting, that is, during November and April, respectively; not only is it dangerous, but post-house keepers use the opportunity to overcharge. Then, also, drivers are not under what little discipline exists when travel is in full swing, and get drunk and cause trouble.

Reindeer and dogs are often used to haul sleighs; the former are fast travellers, covering 12 to 15 kilometres per hour when not hauling heavily-loaded sleighs. Siberia is badly policed, and there is danger of highwaymen, who may be in league with the drivers. These highwaymen have an unchivalrous trick of shooting first and shouting 'hands up' afterward. If a traveller's luggage looks attractive, he may be in great and constant danger both in winter and summer, so it is advantageous never to travel alone, and to have a good pistol handy at all times. The automatic pistol is said to jam in cold weather, and is, therefore, unreliable. Murders and robberies are frequent, particularly in East Siberia, where there are many escaped convicts.

The cost of posting varies. On some of the winter trails it amounts to $1\frac{1}{2}$ to $2\frac{1}{2}$ cents per

horse per kilometre. This means from 3 to $4\frac{1}{2}$ c. per km., with vehicles drawn by two or three horses respectively. By paying excess charges, amounting to about three times this amount per horse per mile, it is possible to get horses ahead of those unwilling to pay more than the regular rate. Winter travelling by sleigh is arduous, for travel is continuous by night as well as by day, and after a few days one gets dead tired. Mining engineers are not likely to do much of this, as it is not usually convenient to make inspections in winter.

Where there are no post-houses, a pair of horses and driver costs at the rate of \$2 to $\$2\frac{1}{2}$ per day, although in case of there being few idle horses, charges may be much more than this.

In spite of the circumstance that the stamina of the Siberian horse is much vaunted, 30 miles per day is considered a long drive. I have driven 50 miles per day for 3 days in Colorado, and for 3

to vehicles in Russia and Siberia is largely responsible for this condition. One horse, hitched between the shafts, does most of the work in pulling, and all of the work in holding



A Dog Team.



Pulling and Poling Canoe.

days in southeastern Utah over sandy roads with the same horses and with much less fatigue to both man and horse than when travelling shorter distances in Siberia.

The uneconomical method of hitching horses

back while going downhill, as there is no brake and the outside horses are so hitched as to not be able to help in holding back.

I recently made a summer trip in Siberia; the distance was 369 kilometres, and the time consumed, including changes of horses, bargaining with many peasants, etc., was 52 hours. Horses were changed 13 times, or every 28 km. on average, and the average time lost at each station was about one hour, which gives a rate of about 7 km. for the trip, or of 9.5 kilometres per hour when actually travelling. This was considered fast time, and the road was good and dry most of the way.

It is well to procure the 'Road Book for Travelling in East Siberia,' costing 5 cents, when journeying there. Distances be-

tween stations, horse-hire, etc., are given. It must be remembered in using it that distances given are not always actual, but extra allowances may be made for rough or hilly road.

No time was lost on account of meals, as

only bread and tea were eaten. These can usually be procured in about 30 minutes, if the servants are hurried constantly. Usually eggs can be obtained, and it is best to open them cautiously and to test their freshness. It is wise to have a basket of provisions, such as tinned stuff, sausage, bread, biscuits, chocolate, etc., and to eat while travelling. If an attempt is made to get a full meal at a post-station, it is likely to take hours.

It may seem that unnecessary details have been entered into, but I give them, after considerable travelling in Siberia and after having undergone disagreeable and uncomfortable experiences due partly, at least, to ignorance of conditions and means of combating them.

screens on windows or doors to exclude flies. As a result, you are constantly harassed by flies in summer, even in the evening, and particularly in mining camps. It is well to provide 'tangle-foot' fly-paper, or other means to kill flies, if eating or doing clerical work is to be done in peace.

Health.—Russia is generally salubrious, but cholera and typhoid always exist, and are frequently epidemic even in many of the large cities. Unboiled water should not be drunk; and vegetables, salad, and fruit should not be eaten unless they have been thoroughly washed with boiled water. Small-pox is common, so a visitor should be vaccinated before going to Russia.



TRANSPORTING A BOILER.

Clothing.—For summer travel an outfit adapted to hot weather is needed, as the temperature during the day is often almost tropical. Nights are always cool, however, and several blankets must be taken. The summers are short and sweet, and the frosts begin in September. In addition to the ordinary summer outfit, mosquito netting should be provided for most of the mining regions.

Fur clothing is necessary in winter, for temperatures 60° to 70° F. below zero are sometimes noted. Satisfactory fur clothing can be procured in the larger towns. It is best to dress just as the Russians do, for long experience has taught what is best in this regard. It is well to purchase all winter clothing in Russia or Siberia.

I have never seen a Russian house with

Cholera may be epidemic in the mining districts. At the risk of being considered diffuse, a few remarks as to cholera are given herewith. It is an infectious disease caused by a bacillus, and it is characterized by violent purging and rapid collapse. As in other diseases, individual susceptibility counts for much; hence those in a debilitated condition, whether through dissipation or other reasons, are likely to be attacked. The disease is not highly contagious, but close association with patients and contact with their linen is dangerous. Cholera bacilli live in fresh bread, milk, butter, and meat. Food may be infected by flies. Infection through air is not to be dreaded. The disease is chiefly propagated by contaminated water used for drinking, cooking, and washing. Water on trains must be treated with suspicion.



A REINDEER SLEIGH.



REINDEERS UNDER SADDLE.

The treatment is the same as for severe diarrhoea. The patient must be supported with whiskey, hot coffee, and brandy, and liquid diet, such as broth. Irrigation of the bowels with hot salt solution (one teaspoonful of salt to one pint of water) is helpful. It is well to provide a syringe for use in such emergency, or in case of severe constipation, which may be the result of inactivity and heavy Wagons. Lits *table d'hote* meals on the long railroad journey across Siberia.

Labour.—A few words on this topic will not be amiss. The labourer is generally lazy, drunken, and unreliable. He has the mind of a child, and must, therefore, be humoured. He is accustomed to doing piece-work, and it is best to arrange for such work when possible. He has poor judgment, and is apt to get hurt through his own carelessness; but his employer is likely to be blamed for accidents, and even arrested. Prospecting work must be so conducted as not to endanger the workmen, and there should always be a responsible foreman who can take the blame for accidents, should any occur, and go to gaol if judged negligent.

Prospecting machinery can be brought into Siberia east of Lake Baikal practically free of duty; for instance, the duty on two Empire drilling outfits costing about \$1000 each was \$12. West of Lake Baikal, the duty amounts to about 40% of the value. Hand-drills can be shipped by express over the Trans-Siberian railway at about the same cost as in America or England.

Living in Siberia.—Good board and lodging are difficult to obtain in the smaller towns, and it may be necessary to live with Siberian peasants, who object to getting up early and whose general habits and irregular mode of life do not please Europeans.

The staple food consists of bread, white and black, beet or cabbage soup, eggs, beef, pork, mutton, potatoes, sour cream, and tea. While this is not a large dietary, nor is it palatably prepared, you can get along on it quite well. The Siberian peasant, when asked how much you owe him for board and lodging is apt to reply: "What you will." About 50 to 75 cents per day is generally sufficient to satisfy him.

Chinese servants can be procured in eastern Siberia. They are in all respects superior to Russian domestics, and should always be employed if available, for only then can meals be obtained regularly and on time. Japanese women can also be had, and they make the best servants for European women.

It is much better to try to live as do the Russians, particularly when travelling, than

to make oneself uncomfortable trying, usually without success, to change things. It is really not difficult to abide by Russian ways, and to eat the Russian food, and it is strongly advised that this be done. It is a great mistake to complain of the food and customs, and a traveller is apt to do entirely too much of this. Not only does it do little or no good in changing things, but it is likely to do harm in engendering hostility and opposition. Russians think well of themselves, and they are a powerful nation, and have that privilege therefore. They are inclined to regard many of our ideas, customs, and manners as inferior to their own, and it is possible that they are right. It is not wise or judicious to criticize and find fault with everything; the less done of it, the better.

Good advice is do when in Russia as the Russians do, and do it uncomplainingly. So drink tea; it is weak, harmless, quenches thirst, can always be procured at every dwelling, and, in being made of boiled water, will not give typhoid fever, dysentery, or cholera. Smoke cigarettes. They, too, are harmless, and cigars are very expensive. Eat beet and cabbage soups. These are sometimes rather greasy, but are also nourishing and, like tea, they can be procured at nearly every peasant hut.

Learn to like sour cream, *smetana*; it is generally used with soup, fish, meat, and even with desert, and it is really good, often resembling cream cheese. Do not complain at the substitute for parsley, which is generally used to flavour fish, meats, etc. You can soon become accustomed to it, and even acquire a liking for it.

To reiterate, abstain from complaint and criticism, for it is not only discourteous, but it is almost sure to do more harm than good. When a residence has been established, it is then possible to engage Chinese servants, and to have what you prefer; but on prospecting trips, this is not expedient.

Remember also that while the Americans are nearly all dyspeptics, the Russians have no such malady. May it not, therefore, be true that their food and modes of eating are superior?

I have attempted to place particular emphasis on the hints given in the foregoing paragraphs, for I have observed how harm is done by what I decry in them.

It is not easy to do business in Russia, and Russian ideas are often different from ours, but this does not mean that the Russian is wrong; and remember, also, that the best way to get on with him is to humour and not to criticize him.

AN EXPERIENCE IN MEXICO

A Mining Engineer's Experience at the time when Durango was captured by the Rebels.

By R. H. JEFFREY.

THE capture of the city of Durango on June 18 by the Rebels, or 'Constitutionalists,' as they style themselves, was both exciting and interesting, for it affords some index of what may happen should other important cities in Mexico fall, whether by force of arms or of disloyalty among the Federal forces. It has been suggested that the General charged with the defence of Durango sold the city for 50,000 pesos, equivalent to £5000. This would not be altogether surprising, although cases of Federal officers accepting bribes are fortunately rare even in Mexico.

A few days before Durango was attacked, there was considerable excitement in consequence of a visit paid to the city by a one-eyed American, popularly considered a spy. The local authorities had no sooner heard of his presence than he was gone. Later events proved that he was a spy, a soldier of fortune, and probably had come into the city to size up its defences, or to arrange for its purchase. *Quien sabe.*

The attack was started on the 17th at 11.30 p.m., the rebels using the old Indian bonfire signals, which could be seen on the hills about midnight all around the town. There was incessant rifle-shooting all night, but no one thought at daybreak that the city was lost, as there were about 2300 men on the defence, including some 800 Federals, 800 State troops, and about 700 volunteers recruited from the best citizens of Durango. The volunteers had been drilled for over a month prior to the attack and openly boasted of their ability to hold the town; indeed, they said they were glad there was to be a chance of their settling the Revolution

in the state of Durango once and for all. They intended to show the bandits, as they called them, that the time had passed when the rich would remain idle and be over-riden by the riff-raff. But when the Federals left, these gallant defenders hunted for safety either in disguise or in hiding. Some left the city with the Federal forces.



After the fall of Durango.

Foreigners were advised by telephone or by messengers from the consulates that the prin-

cipal Federal stronghold had been taken about 8 a.m., when many left their homes to take refuge at places where they thought they would be safer. By 9 a.m. all thought of saving the city seems to have been abandoned by the Federals, and before 10 a.m. they could be seen making a hurried exit in any way they could, while parties of Rebels in twos and threes made their appearance at the street corners, wild and hungry-looking, ready to fire at a shadow, or anything else, their mark being a matter of supreme indifference to them. Before noon the Rebels were in complete control, and commenced to blow-up and sack the town. The doors and windows of all the principal stores were soon opened, anyone and everyone participating in the looting. Realizing the position, the Archbishop of Durango commissioned one of his clergy to go to the Tapias ranch, about six miles out, to bring in the Rebel Generals—Urbina & Co.—seven in all. Two foreigners, Dr. McKissick and myself, accompanied the padre in an automobile, which had not gone far before it was halted by two cut-throats; they took a lot of convincing of our pacific purpose before deciding to let the automobile proceed. A little farther one of the lesser Rebel Generals was met, coming into the town with a few hundred men; he assured us that we needed no guard and that we would not be troubled. The car had not gone much farther, however, before it was again held-up, this time by a volley fired ahead of it. The padre got out, while the Rebels rode down to where the car had stopped. Such fellows! scant of clothing, unwashed, armed with anything from a Mauser rifle to a machette. "Where are you going, *Cabrones*?" "We are going to receive General Urbina." "Are you? Oh, no you are not; you are going to hell. I am going to hang you; you priests are at the bottom of all this trouble, and I've been hoping to catch one of you and hang you ever since I started with the revolutionists." Just then, realizing that something was wrong, I got out of the car, and reaching a wall where the discussion was going on, was surprised to find that the padre's new 'friend' had been employed by me on a mine, where I had shown him some kindness and given him favourable places to work, for the reason that he was not strong in his limbs and could not work—although a good miner—in dangerous places. This saved the padre; the Colonel, for such was the man's rank now, was good natured immediately he recognized me and joked about the entertainment they anticipated in hanging the padre behind the automobile.

The padre never seemed worried, and appeared to be the least concerned. "Take his life," said the Colonel; "I'll give it to you as a token of my affection for you; the *cabron* owes his life to my friendship for you."

The automobile was soon on its way again. All the padre said was: "It would appear that the Colonel does not like the Church. What a barbarian he is." At the ranch, the Generals were taking life easy; Rebel Generals do not often go to the front; they appear to stay a long way from it. There were several of them there; Urbina, Arrieta, and Najara being the recognized chiefs. They were fairly well dressed in khaki, and seemed glad to see us, but expressed great disappointment when we told them we had no beer or cigarettes for them. There were hundreds of Rebels there, some riding around roping cattle, others talking to women near the wagons that carried their supplies. Women and children follow the army everywhere, and it seems quite useless to try to stop their doing so. When General Blanquet, now Federal Minister of War, was at Pedrecena, on one occasion, he sent all women and children to Torreon by train, a distance of about 50 miles; in a few days most of them were back again, having returned by road on foot over, practically speaking, a desert country.

The Generals seemed loth to believe that the Federals had left Durango, and it required some persuasion to get them into the car. They promised to kill us if we were betraying them; we told them we were ready to face that; they were reassured, and orders were given for the guard to mount. The car was loaded down, three Generals got in, and all the Colonels, etc., who could get a foot-hold, hung on. The Pierce-Arrow was a new one, and made its way steadily over the rough roads to the outskirts of the city. Two or three companies of Rebels were then drawn up as an advance guard, trumpets were blown, and the lower classes filled the streets, shouting *Vivas* for the Revolution.

The Richelieu hotel, the best in the city, was selected by Urbina for his head-quarters, but there was no more chance of his getting there than of his flying. The streets were filled with ruffians hallooing, shouting, and throwing bombs, while many were busy sacking stores that had already been opened. The Generals were quite powerless to restore order, and the more the order was given to 'stop firing, *cabrones*' (literally, he-goats) the more the *cabrones* shot; windows seemed to be the favourite target.

There was nothing for it but to go back and try a side street; this was done with difficulty, and other headquarters selected. The Generals were left, and remained there for a day or so; meanwhile the sacking of the city proceeded, and in a few days many of the most beautiful homes were stripped of everything movable, and converted into stables for Rebel horses, while many of the great stores were looted and burned. Sixty or so buildings were destroyed with bombs and fire. Durango had fallen!

For two days Rebels kept coming into the city; there were over 6000 of them in all, some well mounted and armed with Mauser rifles, the majority however, were badly armed, badly mounted, and all were badly clothed. Many had not been washed for weeks and showed that the hardships they had undergone were too much even for them.

The dead were allowed to be buried four days after the city was taken—indeed, order was not obtained sooner. The Rebels seemed to have gone wild, they patrolled the streets in twos, threes, and fours, on horseback or on foot, and held-up everyone in hopes of getting something from them. They took clothing, watches, boots, etc., and in a few days looked more or less respectable. The General took charge of the banks, and held the bank-managers prisoners; they also exacted money from the better classes by putting the heads of houses in prison until the family raised the amounts assessed, from £1000 to £5000 in many cases. Of course, few were able to meet the demands, as the banks had already been taken and all funds were held by the Rebels chiefs, who refused to take cheques on funds which they claimed were theirs. These were days of great anxiety for the better classes, who suffered most.

About a week after the city had fallen, the Rebels had a pay-day. Wagons were driven up to the banks and loaded with pesos; these were taken to headquarters, and as it took too much time to count the money, corn measures

were used. A half-litre measure was filled for each private, and a litre measure for each captain, so that a former *peon* got 90 pesos—say £9—and a captain about £18 on account. All the corn that had been stored in the city, estimated at some 500,000 hectolitres, was confiscated, and doled out to feed the Rebel horses, the gutters being used as mangers.



On the War-path at Avino.

One could see hundreds of horses being fed in the streets with the corn that was poured into them from the great grain stores. The waste was pitiful.

It has been stated that women committed suicide, but this is not correct; indeed, I heard of no single case of a woman being molested in any way. Most of them took refuge in the church buildings, or at the consulate, where they were well cared for, if uncomfortable. Mr. Graham, the British Vice-Consul, gave

protection to all Englishmen and to some 80 Mexicans, while Mr. Hamm, the U.S. Consul, took care of the Americans in the same way. One Englishman was killed, a Mr. Palmer who could not open a safe at an office where the Rebels found him, and one American, Mr. Von Brandis, was severely hurt by an exploding bomb, which had been placed at a door of the house where he was staying and which he was on the point of opening.

The Rebels took all automobiles, horses, and carriages, making use of them to enjoy themselves by riding around the city. The motor-cars soon gave out, some of them being left in the streets with a curse when found useless.

There was a Governor appointed before I left, and the Rebel chiefs had taken advantage of the opportunity afforded by the capture of Durango to clothe their followers with overalls, and to make them look quite respectable by comparison with their appearance prior to this success, when they were as badly clothed as Mexican *peons* generally are; for the majority of them were peasants who had been almost forced to join the ranks from ranches in the State. The rifles, said to be over 1000, taken from the volunteers or left behind by Federals, were issued to those best deserving of them in the revolutionary ranks to replace useless old rifles or *machettes* with which many were armed before the city was taken. The Rebels also claimed to have secured about three hundred thousand rounds of ammunition.

Several foreigners came into the city in the Rebel ranks and made the best of the opportunity to enrich themselves. One, said to be a German ex-captain, went so far as to hold up the padre in charge of the Cathedral, from whom he got 3000 pesos, or £300. He also opened the vaults in the crypt to ascertain whether any monies had been hidden in the tombs of the old bishops, but found nothing.

The Archbishop was placed in gaol and 500,000 pesos demanded for his freedom, but as such a sum was quite out of the question, the Rebel chiefs were content with about 15,000 pesos, collected throughout the city. The British Vice-Consul got him out of gaol on bond on one occasion.

After several days some semblance or order was restored, the Rebel chief maintaining a military rule until the Governor was elected. The election was quite amusing; old cigar-boxes in the lids of which slots had been made, were placed in a few districts of the city with the name of the proposed Governor printed on a slip of paper attached to them. The first

election was declared void, as no one was found to have voted. The second attempt seems to have been more successful, as Ing Pastor Rouix was declared elected, and the cigar-boxes collected.

Since I left some progress must have been made in governing the state by the Rebels; they now print their own money, which people are forced to accept. The new Government claims that this paper currency is guaranteed by the ranches, which they have confiscated for the benefit of their cause.

Lashing is a word used on the Witwatersrand to denote the process of lifting broken ore or rock from the stopes and drifts into the trucks. In other countries words are used that more obviously explain their origin. It is of interest, even at this late day in the history of the Rand, to explain that the word is derived from the Dutch 'laai,' to load. The Zulu worker added his usual terminal and made it 'laai-essa.' The white supervisor easily corrupted this into 'lashing.'

A Load of diamond earth is one of the measurements that are not exact, and reports of the South African diamond-mining companies give only a vague idea of the actual weight and cubical content of this measure. The 'load' is nominally 16 cubic feet of broken mineral, but the weight is not ascertained. Even the experts in the diamond-mining business are not agreed as to the measurement in the solid representing the 'load,' from 10 to 11 cubic feet being quoted by various authorities. The word originated with the old cart used in early days for carrying the earth from the mine to the sorting plants. These carts had a capacity of 20 buckets, of equally undetermined measurement. Why the primitive methods should be perpetuated is not quite clear. The weight of the 'load' may be taken at approximately 1600 lb.

A Claim in the Kimberley diamond district consists of 100 square yards, an unusually small area for active mining purposes. The origin is to be found in the regulations affecting the alluvial diamond industry in the valley of the Vaal river, the ground being on the southern side in the territory of the Orange Free State. The ground promising to yield diamonds was limited, and the number of people flocking thither was great. In order to satisfy demands, the government divided the morgen of land, the standard measurement 100 yards square, into 100 parts thus giving each worker a small portion.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Mine-Managers as Valuers.

The Editor:

Sir—I have read in your issue of August the article entitled 'Mine Managers as Valuers.' The author, Mr. Morton Webber, writes from the viewpoint of the specialist in mine development. As I understand it, Mr. Webber considers the development specialist and the mine-valuer as synonymous. While such an aspect is, to me, somewhat novel it is clear that the mine-valuer must also be expert in the development of mines to enable him properly to consider prospective values. In criticizing I shall pass to the last paragraph but one of the article with the observation that the author convincingly backs his statements with facts in the shape of actual examples from experience.

In dealing with the aforesaid paragraph, I write from the point of view of the mine-owner of limited means who is developing a property with his own money. Mr. Webber states that when a property emerges from its infant stage to a point where a more definite scheme of development should be considered "it will then undergo the most critical phase of its career." Mr. Webber states that a mine-valuer should be employed at this stage to lay out the scheme of development. This work can then be carried on by a mine-manager of a calibre and salary commensurate with the undertaking.

To one who has been directly in touch with the development of mines, and who has both made and lost money in the business, I feel that Mr. Webber deals with one of the key-notes of the industry. That this fact is not sufficiently understood is attested by the mining corps in the shape of worthless properties spread throughout the mining fields of the world. However, writing from the viewpoint of the man who has to foot the bills, does the author realize what a heavy item the fee of a specialist like himself is to a small private syndicate? Mr. Webber's article as a whole gives me the impression that he is evidently more familiar with people who can command the money to follow up their desires than with the little fellow who risks and often starves in developing young mines, which constitute the start and the foundation of the whole business of mining.

Recently a mine-valuer of well-known reputation was in our neighbourhood conducting an examination with some assistants on an adjacent mine. As my property is exactly undergoing the phase described, I called on the engineer in hope that he would take a look at our mine and help us out. As he was within a mile of us, and as I had every arrangement made for fetching him over when he could leave, I was surprised when he bluntly refused to move a foot unless I paid him a fee in advance, which on calculating the amount later proved to be more than two months of our payroll. I was prepared to pay a fee in proportion to the time involved.

In this respect I feel that such avarice on the part of a high-priced engineer indirectly contributes to dishonesty in mining. I believe that many of the mining crooks were originally honest, but many of them get their money tied up through poor directions, and they have to *get it back*. I think a little kindly help in such a case would only ennoble the engineer, and it would stimulate the industry, on which, after all, the specialist depends. I believe that the able and impartial opinion that you could offer hereupon would be in the interest of everybody.

Beyond this criticism as an owner, I can only endorse Mr. Webber's contribution, which is written with characteristic definiteness and can only be criticized on purely academic grounds.

RICHARD WILLIS.

Toronto, September 2.

Future of the Rand.

The Editor:

Sir—Mr. G. A. Troye's paper in your July issue has interested me exceedingly, though, as the *South African Mining Journal* says, we out here are familiar with his views. As the question of the present values of our mining shares is one to which I have devoted a great deal of study for a number of years, I desire to record my admiration of the courage which has induced a prominent engineer to place such views before the public. While my own estimates vary from Mr. Troye's in individual cases, which need not be specified, I am in thorough agreement with the conser-

vatism which, in the main, marks his estimates.

The whole subject of share-valuations being an intricate one, bristling with debatable points, it is with diffidence that I venture criticism in the present instance. There is, however, one feature that calls for comment. I allude to Mr. Troye's requiring the same return on Crown Mines or City Deep shares as on Consolidated Langlaagte. My objection to this is based on two grounds:

(1) It is surely undesirable to place on the same footing (other conditions being equal) two mines on which the respective rates of profit are 12s. 6d. and 7s. 6d. per ton. It is evident that a change for the worse would affect the dividend of the mine earning the lower profit per ton to a greater extent than it would that of the other. The converse of this is equally true, that an increase would benefit the poorer mine to a greater degree than it would the richer. It is, however, the unfortunate experience of those who have to do with gold mines, that the first is the more probable event of the two.

(2) The third mine named lies on the borders of the impoverished West Rand, if not wholly within its boundaries. There is, therefore, less certainty as to the tenour of its gold-contents than in the case of a mine on the immediate Central Rand. This mining field is surely sufficiently well-known for even those with no personal knowledge of it to appreciate this distinction.

WILLIAM BRANSON.

Johannesburg, August 18.

[This letter arrived just too late for our September issue. We agree that Mr. Troye exhibited courage. It is the sort of courage that we particularly like. In mining it is difficult to get unprejudiced views; that is why so many errors of judgment are made. If engineers were themselves wholly detached from the share-market, it would be easier to obtain reliable information for the general public.—EDITOR.]

Tin Deposits of the Central Bushveld Area.

The Editor:

Sir—Absence from Johannesburg is the reason why I have not replied earlier to Mr. E. M. Weston's letter. Mr. Weston's first charge is that I have put forward my theory without one particle of evidence to support it. If he will read my letter again he will see that I state "that in the Potgietersrust district in the northeast, and also in the Warmbaths district in the southwest, the greater number of

fissures have ceased to exist." Surely this statement, which is based on careful observation, is plain enough. If not, I will say in the words of a homely simile that the fissures have disappeared as completely as a hard-boiled egg from its shell. There is not even the sign of a crack remaining at the bottom of the said fissures. Several engineers and geologists from Johannesburg have observed this, and my theory of origin expresses their views. Again, if Mr. Weston will study the maps of the Geological Survey he will find that they show that the tin-bearing sedimentary rocks and felsites that exist on its flanks formerly overlay the Central Bushveld area. Perhaps if Mr. Weston had had the advantage of reading the last annual report of Mr. T. G. Trevor, the Inspector of Mines for the Pretoria district, before he wrote his letter, his protest might not have been so vigorous.

Accessory minerals can be reasonably accounted for by those who hold the belief that the filling of the said fissures by the minerals which exist today was not done in one fell swoop, but occupied a geological age.

The theory that these deposits of cassiterite have originated from tin-bearing vapours and gases, and that the parent body is somewhere below the deepest working, may be grateful and comforting to those pecuniarily interested in the mines of this area, but the facts disclosed by the mining operations in this district are dead against it. How true is the saying "that many a beautiful theory has been killed by an ugly fact."

To Mr. Weston's jest: "The denuded rocks derived their ores from pre-existing rocks likewise denuded, and so on *ad infinitum*," I reply, why not? As you remark, "Many a true word is said in jest."

A great number of geologists think that igneous rocks represent the original crust formed upon the surface of the globe, and that derivative rocks, other than organically derived rocks, are composed of materials derived from the breaking up and disintegration of these rocks by epigene agents. James Geikie, in his book on 'Structural and Field Geology,' states that gold, silver, &c., "have been detected as minute inclusions in the constituent minerals of various igneous rocks," and again that "tin ore (cassiterite) likewise occurs as a primary constituent of many granites, but only in scattered grains and thin veins."

Assuming that these beliefs and statements are correct, would not they be a reasonable explanation of the theory that ore deposits are derived from pre-existing rocks?

There has been ample time for these re-concentrations. Since the discovery of radium, investigations have revealed periods of enormous duration (thousands of millions of years), "and the geologist who ten years ago was embarrassed by the shortness of time allowed to him for the evolution of the earth's crust is now still more embarrassed by the superabundance with which he is confronted." (*Scientific American*, August 2, 1913).

As you say, "ore deposits essentially are re-concentrations; they represent the last phase of a long migration, due to chemical causes and modified by physical conditions."

G. H. BLENKINSOP.

Johannesburg, September 5.

[This matter was also discussed in our last issue. We are always pleased to publish opinions supposed to be contrary to our own.—EDITOR].

Scrambled Brains.

The Editor:

Sir—English practice in the annual reporting to stockholders of the essential facts concerning the operations and financial status of mining companies has long been held up to American companies as the *beau ideal* of company procedure. Certainly it is true that the wealth of tabular detail given in the reports of companies controlled in London presents a marked contrast to the statement of accounts given out by many American companies. To the average shareholder a mere statement of accounts is little better than nothing, for in the absence of knowledge as to the methods of account-keeping pursued, accurate interpretation of them is almost impossible. Such figures as the "working cost per pound of copper," which are displayed so prominently in brokers' circulars, may be exceedingly misleading unless it is known whether all items of cost are included or only the more obvious ones. My intention, however, was to call your attention to the practice which obtains in certain companies, especially Australian, of computing tables and cost data upon bases that are little short of ridiculous. I have at my elbow a report that shows that about 150,000 tons of ore was treated in the cyanide plant, approximately one-third being slime and two-thirds sand. The gold content per ton of sand and slime is stated separately, and the two then added together to give the "total value per ton treated." After pondering over this for a while the reader is naturally in much doubt as to whether his own brains are scrambled, or those of the accountant who drew up the table.

In the case of another company, which had an income of £135,000, I find the cost of all the details of treatment computed on the basis of the total tons milled. The ore milled included a considerable amount of custom ore, and the significance of the cost of stoping per ton of ore milled is not likely to be clear to anyone except the author of the report. By the simple expedient of milling more custom ore next year the manager could show a gratifying decrease in cost per ton for most of the items. That reminds me that I once saw a report made by a well known American engineer in which the gold content in ounces per *metric* ton was the basis of computation. He thus derogated his own work, for the natural inference of every experienced reader would be that this basis of computation was chosen in order that the gold content in ounces would thus appear about 10% greater than by computing it in the ordinary way. It is hard enough for the average man to draw correct deductions from accurate data; why lead him into the bushes with pseudo-data?

THOMAS T. READ.

New York, September 15.

Coaching at the R.S.M.

The Editor:

Sir—We, the undersigned associates of the Royal School of Mines, beg to express our emphatic disagreement with your statement that the junior staff of the school is inefficient. It is our opinion that we owe the greater part of the technical knowledge which formed our professional equipment on leaving the school, to the constant and well directed efforts of that portion of the staff which you have so adversely criticized.

We trust you will give this communication the publicity of your columns in fairness to the junior staff, on whom your remarks if uncorrected can only have an adverse effect, either on their holding their present posts or obtaining fresh employment.

W. M. Gimson,
A. F. Strickland,
A. McCance,
F. D. Gurrey,
E. Gordon D. Wright,
W. Moore,
S. R. Davies,
J. Bernard Solomon,
J. W. Lake,
W. A. Pope,
W. A. C. Newman,
P. Litherland Teed.

QUOTATIONS

of leading mining shares on the London Market.
Shares are £1 par value except where otherwise noted.
Quotations are given in shillings.

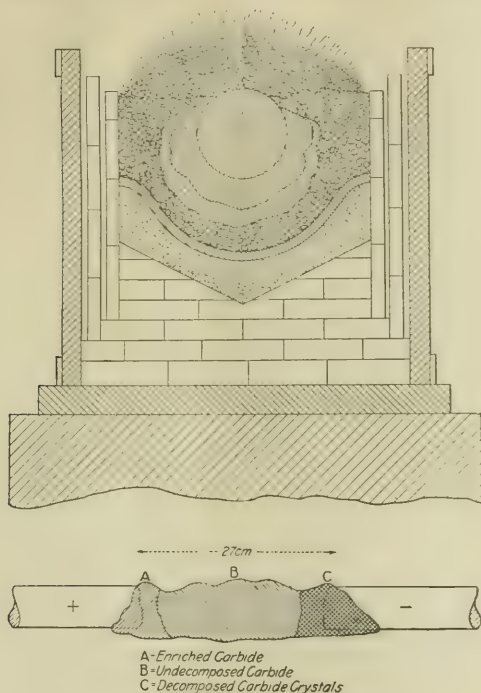
	Oct. 1 1912	Sept. 1 1913	Oct. 1 1913
GOLD, SILVER, DIAMONDS.			
RAND :			
Bantjes.....	23	15	15
Brakpan.....	82	57	56
Central Mining (£12).....	213	167	172
Cinderella.....	20	6	6
City & Suburban (£4).....	47	43	45
Consolidated Gold Fields.....	80	46	49
Consolidated Langlaagte.....	28	25	26
Consolidated Main Reef.....	18	16	17
Crown Mines (10s.).....	145	132	128
Durban Roodepoort.....	22	17	17
D. Roodepoort Deep.....	27	18	18
East Rand Proprietary.....	56	46	46
Ferreira Deep.....	75	57	58
Geduld.....	24	20	22
Geldenhuis Deep.....	30	25	27
Heriot.....	85	60	60
Jupiter.....	11	5	3
Kleinfontein.....	28	18	23
Knight Central.....	13	7	6
Knight's Deep.....	48	35	32
Langlaagte Estate.....	28	22	21
Main Reef West.....	21	8	5
Meyer & Charlton.....	100	97	100
Modderfontein B.....	66	77	74
Modderfontein, New (£4).....	243	220	225
Nourse.....	38	31	28
Primrose.....	38	30	28
Rand Mines (5s.).....	135	120	121
Randfontein Central.....	28	24	24
Robinson (£5).....	72	52	52
Robinson Deep.....	51	32	30
Rose Deep.....	65	50	52
Simmer & Jack.....	21	12	12
Simmer Deep.....	3	2	2
Springs.....	17	15	15
Van Ryn.....	73	68	67
Van Ryn Deep.....	18	29	33
Village Deep.....	42	38	36
Village Main Reef.....	51	36	36
Witwatersrand (Knight's).....	60	54	70
Witwatersrand Deep.....	52	63	56
Wolhuter.....	20	13	15
RHODESIA :			
Cam & Motor.....	38	30	30
Chartered.....	28	21	21
Eldorado.....	36	16	16
Enterprise.....	22	11	14
Falcon.....	29	19	19
Giant.....	46	12	16
Globe & Phoenix (5s.).....	31	25	27
Lonely Reef.....	62	56	55
Shamva.....	72	42	40
Wanderer (5s.).....	3	1	1
OTHERS IN SOUTH AFRICA :			
De Beers (£2 10s.).....	425	415	405
Glynn's Lydenburg.....	27	17	16
Jagersfontein.....	130	128	126
Premier Diamond (2s. 6d.).....	245	250	217
Transvaal Gold Mining Estates.....	55	51	53
WEST AFRICA :			
Abbotiakoone (10s.).....	7	6	5
Abosso.....	21	15	13
Ashanti (1s.).....	19	18	18
Broomassie (10s.).....	4	7	6
Proton Block A.....	18	13	12
Taquah.....	18	15	13
WEST AUSTRALIA :			
Associated Gold Mines.....	7	7	7
Associated Northern Blocks.....	5	11	10
Bullfinch.....	9	16	16
Golden Horse Share (£5).....	50	27	55
Great Boulder Proprietary (2s.).....	10	13	13
Great Boulder Perpetual.....	2	2	2
Great Fossil.....	11	8	11
Island (£5).....	78	61	60
Kalbarri.....	50	41	41
Sea of Gwalia.....	25	22	22
Yamum.....	12	4	4

	Oct. 1 1912	Sept. 1 1913	Oct. 1 1913
OTHERS IN AUSTRALASIA			
Mount Boppy.....	32	15	15
Mount Morgan.....	65	71	72
Talisman.....	40	42	42
Tasmania Gold (10s.).....	2	1	1
Waiki.....	35	45	51
Waiki Grand Junction.....	23	21	22
AMERICA :			
Alaska Treadwell (£5).....	157	162	165
Buena Tierra.....	20	17	17
Butters Salvador.....	40	40	40
Camp Bird.....	28	17	16
El Oro.....	15	14	15
Esperanza.....	38	21	18
Granville.....	16	11	12
Mexico Mines of El Oro.....	142	112	117
Oroville Dredging.....	5	7	6
St. John del Rey.....	17	16	15
Santa Gertrudis.....	31	20	18
Stratton's Independence (2s. 6d.).....	2	2	2
Tomboy.....	27	26	26
RUSSIA :			
Lena Goldfields.....	75	55	47
Orsk Priority.....	21	10	10
Siberian Proprietary.....	13	2	3
INDIA :			
Champion Reef (2s. 6d.).....	12	12	10
Mysore (10s.).....	112	105	102
Nundydroog (10s.).....	34	25	25
Ooregum (10s.).....	18	21	21
COPPER :			
Anaconda (£5).....	190	157	152
Arizona (5s.).....	42	40	40
Cape Copper (£2).....	150	125	115
Chillagoe (10s.).....	4	1	1
Great Cobar (£5).....	100	43	35
Great Fitzroy (5s.).....	2	1	2
Hampden Cloncurry.....	65	63	63
Kyshtun.....	21	30	30
Messina (5s.).....	155	116	97
Mount Elliott (£5).....	28	25	26
Mount Lyell.....	1630	1585	1575
Rio Tinto (£5).....	33	34	33
South American Copper (2s.).....	85	71	55
Spassky.....	56	49	47
Tanganyika.....	135	147	152
Tharsis (£2).....	27	16	15
Whim Well.....			
LEAD-ZINC :			
BROKEN HILL :			
Amalgamated Zinc.....	39	33	30
British Broken Hill.....	52	38	38
Broken Hill Proprietary (8s.).....	52	36	36
Broken Hill Block 10 (£10).....	45	27	27
Broken Hill Block 14 (25s.).....	13	6	8
Broken Hill North.....	158*	51	48
Broken Hill South.....	170	152	145
Sulphide Corporation (15s.).....	30	27	27
Zinc Corporation (10s.).....	17	18	17
TIN :			
NIGERIA :			
Abu (5s.).....	—	12	14
Bisichi.....	23	21	20
Jos (5s.).....	7	8	9
Kaduna (5s.).....	27	20	20
Nararuta.....	31	38	38
Nigerian Tin.....	18	27	30
N. Nigeria Bauchi (10s.).....	6	5	4
Rayfield.....	22	23	21
Ropp.....	55	152	142
OTHER COUNTRIES :			
Aramayo Francke.....	29	32	35
Brisers.....	9	8	8
Cornwall Tailings.....	37	25	21
Dolcoath.....	24	22	19
Geavor (10s.).....	19	21	22
Gopeng.....	77*	31	31
Mawohi.....	28	20	22
Rocheberg.....	31	28	28
Tokka.....	67	62	67
Tromb.....	75	61	51

* Capital re-arranged during year.

PRÉCIS OF TECHNOLOGY

Artificial Diamonds.—In *Metallurgical and Chemical Engineering* for June, Francis P. Mann gives an account of experiments made by E. de Boismenu, of Paris, in connection with the production of diamonds from calcium carbide in the electric furnace. These experiments were made in 1907, but nothing was published until recently, when Mr. de Boismenu issued a pamphlet for private distribution. He has also in *Engineering* for September 12 given some further information. The process consists of electrolyzing fused calcium carbide by means of a direct current. The furnace is open, and pressure is not used, as was the case with Moissan's experiments on crystallizing diamonds out of molten high-carbon iron.



The furnace used by Mr. de Boismenu was of simple firebrick construction with an inner space 30 by 20 by 20 in. The bottom was made of layers of brick and had a V-shaped section. Upon the brick was a layer of powdered lime and carbon, containing 80% lime, and upon this rested a trough-shaped vessel made of fused carbide. The electrodes were round carbons $6\frac{1}{2}$ in. diameter and 5 ft. long. In commencing operations, small pieces of carbide were fed round the electrodes, and the latter were gradually separated as the mass heated. The full charge was 8 lb. of carbide, and over it was placed a layer of lime and carbon, and a firebrick top. The distance between the carbons was $9\frac{1}{2}$ in. The current was 800 amperes at 35 volts. After a 12-hours run, the furnace was allowed to cool. A fused mass adhered to the two electrodes, as shown in the illustration. The middle part consisted of unaltered carbide, and round the positive pole the carbide was finer and more crystalline. The part round the negative pole appeared to consist entirely of carbon in a light and spongy condition and of a black colour. This part was removed in water and

the resulting mud dried. In it were found crystals, which under tests made by Professors Lacroix and Maquenne were proved to be pure carbon, in fact diamonds. Some of the crystals had well defined faces, and others had the form of rounded drops. The length of time of complete fusion in the furnace governed the size of the diamonds. After 12 hours crystals as large as 2·7 millimetres were obtained. Experiments with longer periods have not been made.

The theory of the reactions in this furnace is not clear, and calls for further information. According to the usually accepted idea, the carbon separated from the carbide should be found at the positive and not the negative pole. It is stated that during the working of the furnace pink flames characteristic of burning calcium vapour escape from the negative region, and that the region of the positive pole is enriched in amorphous carbon. So that in the main, it is claimed that the general theory is not contradicted.

Extracting Tin from Ores.—Much has been heard recently of a wet process for extracting tin and wolfram from ores, invented by James W. Chenhall, of Devonshire. *The Mining Journal* for September 6 contains a description of the process. The ore, after crushing, is mixed with fine coal dust, and heated in a closed furnace until the oxides of the metals are decomposed and reduced to metallic form. Care is taken in subsequent cooling that the metals do not reoxidize. The gas evolved from the coal is used continuously for maintaining a reducing atmosphere. If the ore contains sulphur or arsenic, a preliminary roast is given. The ore, after coming from the reducing furnace, is leached with sulphate of iron, which is produced by adding dilute sulphuric acid to the ore. Usually the ore contains iron, but if not some must be added. This solution extracts 85% of the tin content. The ore is afterwards washed and treated with dilute hydrochloric acid in order to extract the remaining tin. The metal is precipitated from these two solutions by sulphuretted hydrogen as sulphide, which is roasted to oxide. The waste liquors are evaporated; sulphate of iron is recovered from the first solution and red oxide of iron from the second solution, both of them saleable products. The tungsten in the residual ore is extracted by means of an alkaline solution. We content ourselves with the above outline of the process, and refrain from discussing its scope, intended application, or economics, all of which are far from clear.

Microscopical Examination of Coal.—In our issue of February 1912 we gave a précis of a paper by James Lomax, which contained a record of the first researches by means of microscopical slides in connection with the constitution and origin of coal. At the September meeting of the Institution of Mining Engineers, Mr. Lomax returned to the subject, and in particular gave a microscopical analysis of various coals, describing the dissemination throughout them of pyrite. The information given helps in the discussion as to the relative influence of pyrite and oxygen in increasing the temperature of the refuse and unhoisted coal underground to such an extent as to occasionally cause spontaneous combustion. We gave in our July issue a précis of a paper connected with this discussion.

Mr. Lomax in his first paper has shown that the microscope reveals the presence of the remains of plants of the club-moss and horse-tail types, and of cycads and conifers. Thin slices can be prepared that show the structure and the order of deposition of the various laminae. The various megaspores and microspores can be identified, as well as layers of humic

matter from leaves, and resinous and other matters. In addition it is possible to trace the more important structures formed subsequently to the deposition of the vegetable debris. In the paper now presented, over a hundred microscopic sections are described, and the results tend to show that even the best parts of the seams may contain pyrite in fine strings, patches, pockets, or crystals. This class of coal, however, does not weather either above or below ground, and the pyrite has little or no chance of oxidizing. Mr. Lomax gives particulars of a new structure detected when examining microscopically coal from the middle seam at the Norton colliery, South Staffordshire. This structure

paper to show that pyrite in coal does not only occur massive or in laminae, but as a replacement of animal matter, and so fine as to be undetected by the naked eye.

Production of Petrol from Heavy Oils.—In recent issues, reference has been made to a proposed process for producing light hydro-carbons from the heavier portions of the petroleum flows. For many years the heavy petroleum oils have been distilled for the production of so-called oil-gas, so extensively used for illuminating purposes on railways. As regards the production of petrol for power purposes, it is interesting at the present time to record that for several

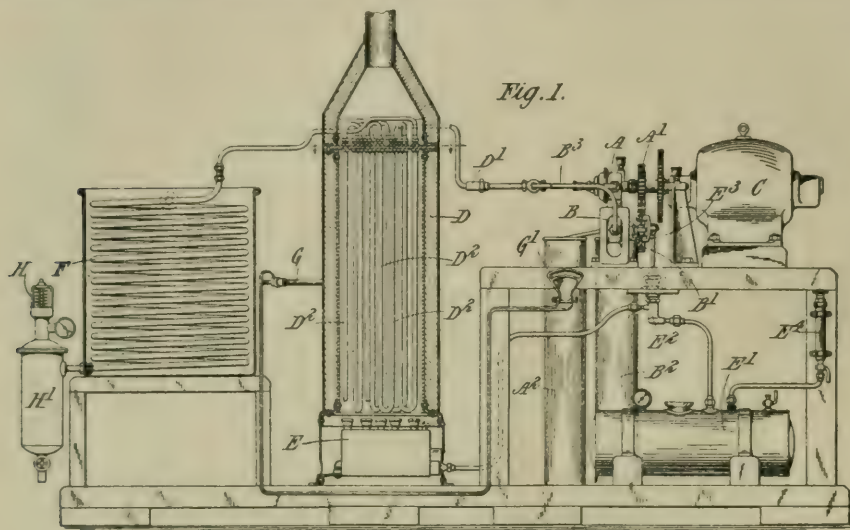


Fig. 1.

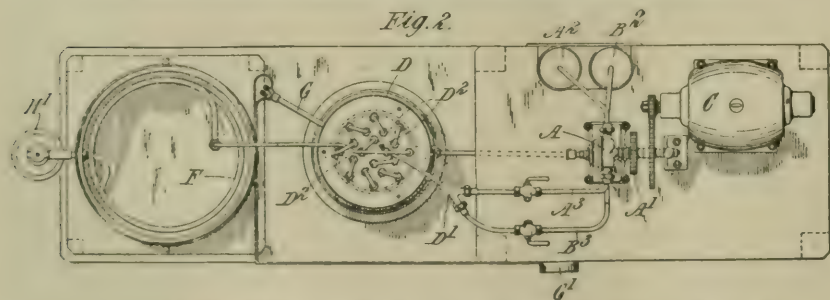


Fig. 2.

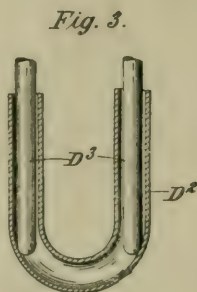


Fig. 3.

LAMPLOUGH'S APPARATUS FOR PRODUCING PETROL FROM HEAVY OILS.

is almost invisible to the naked eye except when it appears in a fairly thick band. In the samples shown at the meeting, the structures were disseminated in groups, and their appearance was that of a number of fine grains of pyrite congregated together. The slides showed the structures to be apparently organisms, existing in both pyritized and unpyritized condition. Though only a surmise, it is allowable to consider them the remains of organisms belonging to the animal kingdom, and Mr. Lomax calls them *pyritica stellata*. They have a number of arms radiating in a manner similar to a star-fish. Each ray is seen to be composed of a sort of shell or sarcoid more or less of a palisade formation, the central body being perforated by a canal. The pyrite replaces the sarcoid matter in part. We give the above quotation from Mr. Lomax's

years the natural gas from oil-wells in Pennsylvania and other parts of the United States has been fractionally condensed, the result being the production of a stable liquid petrol, or gasoline as it is called there, leaving a gas that does not shed its heavier portions as liquid. During the past year much has been heard of a new invention intended for the dissociation of heavy petroleum oils and the production of the petrol series. As this subject is of interest to every engineer connected with oil-finding and oil-production, it is desirable to give the details of this new method of enhancing the value of petroleum products. The British Motor Spirit Company has been formed to acquire and develop the invention of Frederick Lamplough, an engineer well known in connection with motor-car work. The British patents are numbered 19,702 and 28,101

of 1912. The invention consists of subjecting a mixture of heavy oil and water to heat under pressure in coils containing nickel, which acts in a catalytic manner to make the steam and vaporized oil react for the dissociation of the latter. The use of the nickel is the essence of the invention. The employment of high pressure is claimed as part of the process, and an apparatus is included in the patent for controlling the process in such a way as to ensure the existence of this pressure. The accompanying illustrations, Figs. 1 and 2, show the apparatus employed. The pumps A and B draw crude oil and water from the reservoirs A_1 and B_1 respectively, and force them along pipes A_2 and B_2 and through a union D_1 to pipes D_2 contained in a vertical retort D . This retort is heated by

Bwana M'Kubwa Copper Deposit.—The report made by S. J. Speak gives for the first time a detailed description of the Bwana M'Kubwa copper deposit, situated in Northern Rhodesia. The mine is 491 miles by rail north of the Victoria Falls. At present the nearest port is Beira, 1448 miles away. The railway connection is circuitous, and economic conditions would be improved if a connecting railway could be built from Broken Hill to join the Lomagundi railway and thus give a more direct access to Salisbury and the Beira railway. A stony ridge or kopje 2400 ft. long rising from a level plain marks the outcrop. The deposit consists of a central rich orebody dipping nearly vertically, 1800 ft. long at the 100-ft. level, and averaging 4 ft. thick, and orebodies on each side, of lower



MAP OF RHODESIA SHOWING POSITION OF BWANA M'KUBWA.

an oil-burner E , which receives its supply from a tank E_1 , through a pump E_2 . These pumps are actuated by a motor C , and differential gear regulates the relative amounts of oil and water sent to the pipes D_2 , and the amount of oil sent to the burner E . The tubes D_2 contain nickel rods D_3 shown in the enlarged detail, Fig. 3. The heat is maintained so that the temperature of the nickel rods shall be at about 900°F. , the temperature of a dull red heat. The discharge from the tubes D_2 , consisting of steam and gas, is led to condensing coils F , where it is separated into water, permanent gas, petrol, and unaltered heavy oil. The feed through D_1 is regulated by the pumps A and B in such a way that a proportion of 20 to 60 parts of water to 100 parts of oil is maintained. In practice it is found best to pass the heavy oil and water rapidly through the pre-heated tubes, so as to make a minimum of permanent gas. The pressure within the apparatus can be regulated by the relief valve H .

grade and measuring 30 to 60 ft. thick. Five vertical shafts have been commenced in the hanging wall of the central orebody; one of them was sunk to 528 ft., when excessive water prevented further exploration at depth. The 100-ft. and 250-ft. levels are about 1800 ft. long, the 350-ft. level 357 ft. long, and the 450-ft. level 95 ft. long. Cross-cuts have been driven into the hanging wall and foot-wall at intervals. The central orebody is friable and porous, and consists largely of silica and carbonates of copper. Its specific gravity in place is only 1.25, and this unusually low figure accounts for previous errors in the estimates of tonnage. Below the 350-ft. level it changes abruptly into silicious dolomite, and the copper content diminishes, occurring then partly as carbonate and partly as chalcocite. The amount of rich ore is estimated at approximately 50,000 tons, averaging 12% copper. The carbonate is not evenly distributed, but occurs as small bands up to 4 in. thick. The hanging wall con-

sists of quartzite and the average thickness is 35 ft., assaying 4% copper. There is no true foot-wall. The orebody merges into 4 to 10 ft. of decomposed rock carrying little copper, and beyond this is quartzite averaging 60 ft. thick and 4% copper. These two quartzite orebodies are extensive and 1,000,000 tons is proved above the 2nd level. The copper minerals in the quartzite are roughly as to two thirds chalcocite and as to the other third carbonate. Mr. Speak is of opinion that the central orebody was originally a bed of dolomite and that the copper was introduced from the surrounding quartzite by surface waters, the acid of which removed most of the lime and magnesia. An examination of the quartzite without the microscope indicates that the quartzites were sedimentary rocks, probably dolomitic sandstones, which were silicified at the time their copper content was introduced. Microscopical examination showed the hanging-wall quartzite to be a slate-blue fine-grained highly silicious rock, throughout which is disseminated small particles of erubescite and green copper carbonate. A section showed the rock to consist mainly of angular quartz grains, which had not been much eroded by water action. Felspars (plagioclase and microcline), a few flakes of muscovite and a few grains of tourmaline were present, but the bulk of the rock consisted of granular quartz. The foot-wall quartzite is similar to the hanging-wall rock as regards the minerals that compose it, but it contains both angular and rounded granular quartz; also a small amount of graphitic matter is present. Very little iron is present in the ore. No granite or other igneous rock has as yet been discovered in the neighbourhood. The surface of the country is so thickly covered with soil that geological study is difficult. The metallurgical problem is discussed in another part of the magazine.

Nickel Ores in Norway.—The monograph on nickel prepared by A. P. Coleman for the Canadian Department of Mines is naturally concerned chiefly with the Sudbury deposits, their geology, the method of mining, and the metallurgical operations. But not the least interesting part of the work is that containing Mr. Coleman's descriptions of deposits in other parts of the world and his comparisons of the various occurrences with those of Sudbury. He personally visited some of the deposits in Norway and Sweden, and his remarks thereon are therefore worth quoting. The Swedish deposits were first definitely identified as containing a new metal by Cronstedt, who in 1751 contributed a paper on the subject to the Stockholm Academy. In practical work, however, little metal has subsequently been won from Swedish ores, and Norway has contributed most of the Scandinavian yield. In 1893-4, J. H. L. Vogt examined these deposits and published several articles on the subject in the German papers. He gave details of 40 outcrops in Norway, scattered over various parts of the country, most of them being in pre-Cambrian schists, and always accompanying areas of norite or of gabbro too much weathered to reveal its original constitution. He discussed the relations between the size of the orebodies and the areas of norite with which they are connected, and he arrived at the conclusion that large orebodies are generally in large areas of the eruptive rock, and *vice versa*. This conclusion may be compared with the results of mapping in the Sudbury district, where the largest deposits are at bays of the norite, where the width of the nickel-bearing eruptive is greatest. Mr. Coleman visited the only nickel mine at present being worked in Norway, or indeed in Europe. This is the Flaad mine in Saetersdal, sometimes called the Evje mine, from the village three miles to the south,

where the smelter is situated. The mine is on a steep hill rising several hundred feet above the valley and was opened in the beginning as a copper mine, like the Sudbury mines, and was only later discovered to contain nickel. The ore is at the edge of a mass of norite six miles long, now weathered so that no hypersthene remains in thin sections, and greatly resembling coarse weathered norite from the southern nickel range at Sudbury. The country rock is hornblende gneiss or amphibolite, penetrated by coarse and fine grained granites. The norite close to the orebody is thickly shot with spots of ore, a true pyrrhotite-norite, merging into ore on the one side and norite free from ore on the other. The sulphide minerals collected are pyrrhotite and chalcopyrite, the latter tending, as at Sudbury, to follow the crushed edges of the country rock. Some magnetite was observed in the wall of the shaft, an unusual mineral in the Sudbury mines. Dikes of aplite from a few inches to a foot wide penetrate the country rock and also the ore, and a dike of pegmatite 30 ft. wide cuts the norite, but some ore penetrates the aplite in thin seams, as happens in the diabase dikes cutting the ore at Creighton mine, at Sudbury. The ore deposit, which has been followed downward on an incline of 45° to a depth of 530 ft., began on the surface with a length of only 67 ft., but in depth it has increased to 330 ft. The ore often encloses rock matter as small or large masses, sometimes angular and sometimes rounded. Selected ore, at the time of Mr. Coleman's visit, ran 4.6% nickel and 1.5% copper, but the average was stated to be 2.3% nickel and 1.2% copper. The daily output was 115 tons of ore, and it was sent down by rope-way to the smelter at Evje, 3 miles to the south. The ore at the smelter contained much gangue and looked no richer in sulphides than some rock-dumps near Sudbury; but the costs of mining and smelting are so low in Norway that the ore appears to be worked at a profit. It is of interest to note that the matte produced at the Evje smelter is refined by the Hybinette process. Some reference has been made in the semi-technical press to this process within the last year, and the details were far from correct. It is convenient therefore to refer our readers to Mr. Coleman's monograph which contains a reprint of the Hybinette patent for separating the nickel, copper, and iron from the matte by an electrolytic process.

Testing the Action of Cyanide Solutions.—In the *Colorado School of Mines Magazine* for September, R. B. Elder describes the method of testing the action of cyanide solutions adopted at the Chiksan gold mine, Korea. At this mine a cyanide plant was installed to treat the accumulated sandy tailing left after amalgamation and the removal of pyrite by concentration. The average content of this tailing is 2 dwt. At first 75% was extracted, but by careful study by means of the device described, this was increased to 85%. Mr. Elder installed an apparatus for measuring the flow and content of the solution as it leaves the leaching vats, and made determinations thereby at frequent intervals, plotting the results graphically. The apparatus is made on the tilting-box principle, as shown in the illustration, Fig. 1. A dash-pot is provided to control the oscillations of the box. The supports are so arranged that the box may be raised or lowered with respect to its axis of rotation, and the amount of solution required to tip it thus adjusted. The sampling device is a glass tube bent at both ends, and allowed to rest with one end loosely in the neck of the sample-bottle, and the other in the moving edge of the box. The portion of the tube projecting into the bottle-neck keeps it in position. When the box tips

toward the bottle, the end of the tube in the box dips into the solution, and the bend of the tube retains a small portion of it. At the next motion of the box, the end of the tube is elevated, and the small quantity of solution it contains is poured into the sample-bottle. In this way each portion of solution discharged by a forward and back motion of the box is represented in the sample. The amount of solution indicated by one unit on the counter is slightly increased by an increased flow of solution, owing to the variation in the amount of solution which escapes unmeasured while the box is in motion. To correct this

the amount of gold delivered. An example of the application may be given: Suppose the cost of allowing the percolation to continue is ascertained and plotted on the sheet in terms of the same units as the gold production. The time at which the percolation should be discontinued and the vat re-charged in order to obtain the greatest net profit per ton under these conditions, is at the point of intersection of the gold-extraction line and the cost line. In order that the result may be strictly true, it is necessary to correct the gold-extraction line to allow for losses and cost of precipitation and melting. The following aids in ex-

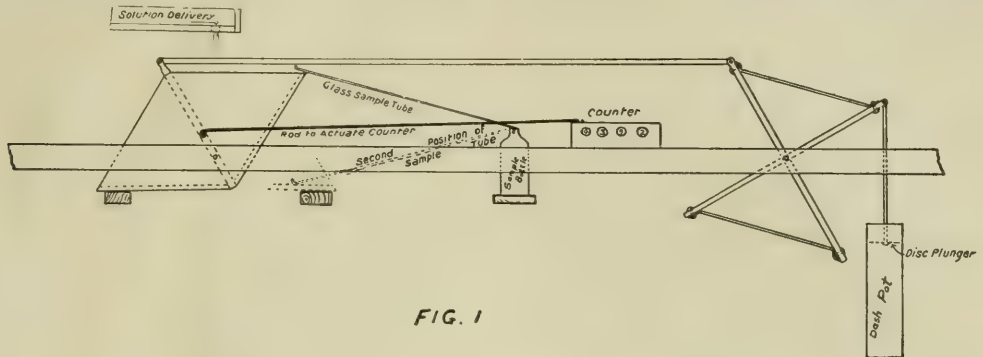


FIG. 1

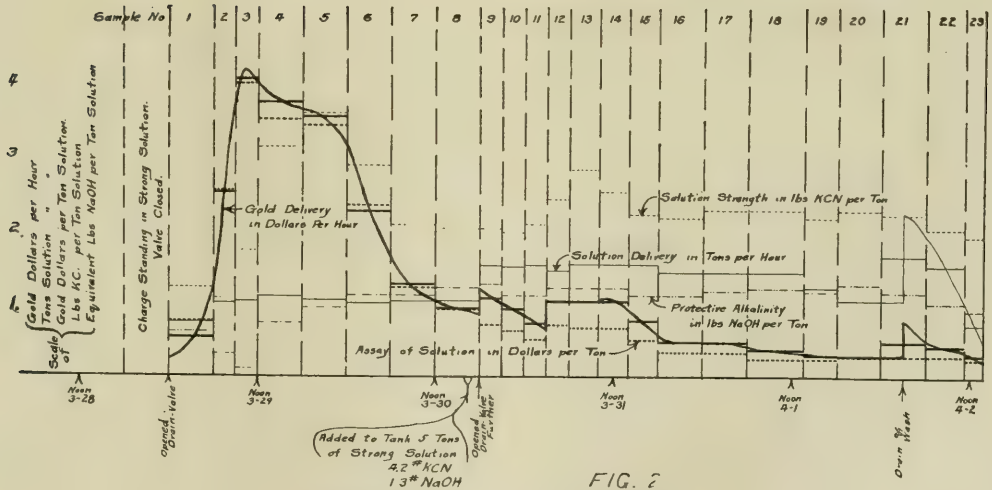


FIG. 2

THE TESTING OF CYANIDE SOLUTIONS.

error, the apparatus may be calibrated on several rates of flow of the solution. The meter is placed so as to discharge into the pregnant solution sump. The solution from one of the leaching vats is diverted from the main launder and passed through the meter. At regular intervals the meter-reading is recorded, and the accumulated sample of solution is marked and set aside for assay. The results from a set of samples covering the treatment of one charge are plotted together, using different coloured lines for the elements for which a test is made. These curves give the operator exact information as to the effects of varying treatment, and so assist in the standardization of the operations. The ordinate (Fig. 2) of any point on the gold-production curve represents the rate in penny-weights or dollars per hour at which the gold comes from the vat, and the area under the line represents

planation of Fig. 2: At 6 p.m. on March 18, the charging was completed, and solution carrying $3\frac{1}{2}$ lb. KCN and protective alkalinity equal to 1.3 lb. Na OH per ton, was added until the charge was covered. This was allowed to stand until midnight, and then the drain-valve was opened. As the solution was drawn off, solution carrying 2 lb. KCN and 1.2 lb. protective alkalinity was added, so that the charge was always covered.

Primary Chalcocite at Butte.—The question of the various sulphides of copper being of primary origin or products of secondary enrichment continues to provide discussion. 'The latest contribution to the literature of the subject is Reno H. Sales' paper on the ore deposits of Butte, read at the recent meeting of the American Institute of Mining Engineers.

Owing to the persistence to great depths of chalco-

cite in the Butte copper veins much interest has been aroused among geologists concerning the manner in which it was formed. In recent years the opinion has been generally held that chalcocite is largely, if not wholly, a product of descending sulphide enrichment. This view arose naturally through the discovery of the so-called black sulphurets (later proved to be sooty chalcocite) of Ducktown, Bisbee, and similar pyritic orebodies. In these cases, belts of black amorphous chalcocite were found separating the oxidized zone from the lean pyritic ore below, and they were believed to have resulted from the reaction between the descending copper sulphate waters and the unchanged primary ores below. That this view was the correct one for the sooty chalcocite of this class of deposits has been abundantly proved by recent investigations.

The discovery of similar chalcocite ores in the early mining operations at Butte led many observers to the opinion that these remarkably rich ores were likewise of secondary origin and of limited vertical extent. When the zone of sooty chalcocite was penetrated, however, the predicted lean cupiferous pyrite ore was not found, but chalcocite-bornite-enargite ores were encountered, which have persisted to great depths. The chalcocite of the deeper levels does not occur in the sooty form, but instead, it is the grey massive mineral more or less intimately mixed or intergrown with bornite, enargite and other minerals which have replaced altered granite. It is not necessarily a replacement of pyrite or any other sulphide mineral, but was deposited directly from solution as chalcocite in veins along with bornite and other copper sulphides.

An intimate acquaintance with these ore deposits extending over a period of years has led Mr. Sales to the conclusion that most of the massive chalcocite is of primary origin, in the sense that it was deposited in its present position directly from deep-seated ascending solutions. Secondary chalcocite exists in large quantities also, but it is believed to be of limited vertical extent, being confined principally to the well-known sooty chalcocite zone extending from the bottom of the oxidized zone to depths ranging from 100 to 1200 ft. It should be clearly understood, as previously stated, that the sooty glance zone has no well-marked lower limit, and furthermore, in the generation of sooty glance by descending waters, massive chalcocite is frequently developed, especially where the replacement of pyrite or other sulphide has reached an advanced stage. It is impossible to differentiate in hand specimens between primary and secondary chalcocite when both appear in massive form. There is of necessity in many cases an overlapping of primary and secondary chalcocite in the veins, inasmuch as primary chalcocite is believed to have originally extended to an elevation higher than the present ground surface. It follows, therefore, that to some extent primary chalcocite has been subjected to the action of atmospheric agencies along with the associated primary vein minerals. The result has been a sooty glance enrichment of the primary minerals of the ore, among which there existed massive chalcocite.

The observed facts which have led the writer to the conclusion that primary chalcocite exists in large quantities in the Butte veins may be briefly stated as follows:

1. The occurrence of chalcocite in great abundance at levels 3000 ft. or more from the surface.
2. The intimate association of chalcocite with bornite, pyrite, and enargite in such a manner that all must be regarded as having been deposited at the same time and under similar conditions.
3. Chalcocite is found at all depths without regard to surface topography, which fact tends to show that

no relation exists between the occurrence of chalcocite and present-day downward-seeping waters.

4. Chalcocite occurs in absolutely dry veins and ore-shoots at deep levels, and in many instances large bodies are cut by older faults, a fact further tending to show that this copper mineral is an old one and in no way genetically related to the present-day or a former similar underground water circulation.

5. Chalcocite directly replaces altered granite at deep levels. The power of cold meteoric waters to effect direct replacement of granite in quantity may be seriously questioned.

6. No evidence is available tending to show that chalcocite is now being deposited in the veins, except within the sooty chalcocite zone. On the other hand, where positive evidence on this point is obtainable, it indicates a tendency of the massive chalcocite to alter to bornite and chalcopyrite under present ground-water conditions.

Metallurgy at Cobalt.—We have, in our issues of June 1912 and June 1913, given details of the cyanidation-amalgamation method adopted for the treatment of high-grade silver ore and concentrate at the Nipissing mine, Cobalt, Ontario. In the *Canadian Mining Journal* for September 15, Reginald E. Hore gives particulars of a similar process adopted at the Buffalo property. He also describes the O'Brien metallurgical plant, where aluminium powder is used instead of zinc for precipitating the silver from the cyanide solution, this practice being similar to that at the Deloro and Nipissing plants.

The Buffalo mill for treating the high-grade ore and concentrate was erected during the summer of last year, and was put into commission in November. The material is dried and ground in a Krupp ball-mill having a 30-mesh screen, the metallics being removed during grinding. It is then sent in 5-ton charges to a tube-mill, measuring 5 ft. 6 in. by 20 ft., together with an equal weight of mercury and 40% of a 5% cyanide solution. The tube-mill is revolved for 9 or 10 hours until the whole charge is less than 200-mesh. The charge is then delivered into an iron settler, from which the mercury and amalgam are removed to a clean-up pan. The ore in the settler and the overflow from the clean-up pan are passed to a second settler, and thence to Parral vats. After agitation, the pulp passes to a Burt filter. Precipitation is effected by means of zinc shavings. As regards the tailing left after concentration, the slime portion is cyanided.

At the O'Brien plant, the ore from the mine is crushed to $1\frac{1}{2}$ in., after the richer portions have been removed by hand-picking. The crushed ore is sized in a trommel. That above $\frac{3}{4}$ in. is sent to a Harz jig; that from $\frac{3}{4}$ in. to $\frac{1}{2}$ in. and that from $\frac{1}{2}$ in. to $\frac{3}{8}$ in. to Richards jigs; and anything less than $\frac{3}{8}$ in. passes direct to the stamps, together with the middlings and tailings from the jigs. The jigs remove about 20% of the silver content of the ore. A $2\frac{1}{2}$ -lb. cyanide solution is used in the stamps, and the material is reduced to pass a 0.077 in. aperture. After discharge the pulp is classified in a Dorr machine, and the coarser part re-ground in Hardinge pebble-mills. The sand produced in these mills is passed over Deister tables, which recover about 40% of the total silver of the ore. The overflow from the Dorr classifier is sent to a Pachuca vat, where the cyanide solution is made up to 5 lb. After 48 hours agitation the pulp goes to Moore filters. In the precipitation vat, aluminium dust is used, stirring being maintained for half-an-hour. This metal is more costly than zinc, but less of it is necessary. It gives a high-grade bullion, and it regenerates the cyanide combined with the metals to be precipitated.

Mond Nickel Smelting Plant.—In quoting from A. P. Coleman's monograph on 'Nickel in Canada' the *Mining and Scientific Press* for September 13 gives additional particulars of the new smelting plant erected by the Mond Nickel Company, at Coniston, Ontario. We reproduce these notes here, as little information is as a rule available relating to the work done by this company. The new site is much nearer the present chief producing mines of the company, is only a short distance from one of the electric-power plants of the Wanapitei power company, and has an ample water-supply. The plant is designed for a capacity of 2000 tons of ore per day, and is in general similar to the plant of the Canadian Copper Co., with the exception that no reverberatory furnaces are used. It is probable that when the supply of fine ore and flue-dust reaches its maximum, a Dwight-Lloyd sintering machine will be installed to handle it. The mine ore, containing nickel and copper in about the proportion of 2.6% nickel to 1 of copper, and with a 25% sulphur content, is roasted in heaps, the roasting yards being so placed that the sulphur fumes will not cause trouble. When the sulphur content is reduced to 11 or 12%, the heaps are reclaimed with steam-shovels and the ore loaded into cars which transport it to the smelter-bins. The ore, limestone, and coke are drawn out through hoppers into charging cars, and weighed in the usual way, and are then dumped direct into the blast-furnaces. These are 50 in. wide and 20 ft. long, using a height of charge above the tuyeres of 11 ft., and a blast pressure of 30 to 40 oz. About 500 tons per day is smelted, making a slag that runs 30 to 40% SiO_2 . Space has been provided for four blast-furnaces, two of which are already constructed, and one is in blast. The plant has only been in operation two or three months, so that working conditions are still somewhat abnormal and the coke consumption is accordingly high. The furnace yields 70 to 80 tons per day of matte containing about 20% of copper and nickel combined. This is tapped off from the settlers into pots handled by the crane and is dumped into the Peirce-Smith converter, where it is blown to a matte containing 80% copper and nickel combined. As a result of closing down the old plant and starting the new, a large amount of difficult material requires to be handled, and the converter is made to do as much smelting work as possible. It is therefore worked to full capacity in spite of the apparently small tonnage of matte treated. The converter slag is poured direct into the blast-furnace settlers.

The Channel Tunnel.—The project of tunnelling the English Channel from Dover to Sangatte has been considered from time to time during the last 100 years, but the proposition did not assume any importance until the seventies. Four thousand yards of work was then done, when the British Government stopped operations, for military reasons. Tunnelling has made many strides since then. The scheme has been revived recently. The *Engineer* for September 26 contains a report of a lecture by Sir Francis Fox on the subject.

In 1876 and 1877 the French geologists, Potier and Lapparent, took 7600 samples of the bottom of the Channel. The grey chalk through which the tunnels would be bored, if the scheme were sanctioned by his Majesty's Government, was 87 ft. thick at Dover and 70 ft. thick at Sangatte. It was excellent material in which to work, possessing the peculiar property of gradually puddling itself, and becoming impervious. Containing no flints, it was, as far as could be ascertained, free from fissures and slides; but should a fissure be encountered, it could be easily and satisfactorily dealt with by means of the system of high-pressure

grouting which had been introduced within the last five or six years.

A drainage heading would be driven from each side of the Channel, rising towards the centre, and connected at Dover and Sangatte with shafts for pumping and winding. The main tunnels would consist of two single-track circular tunnels, each of 18 ft. net internal diameter, and thus large enough to accommodate the rolling stock of the British and French main lines, except only their locomotives, for which would be substituted electrical locomotives of ample power to deal with the heaviest trains running upon the main lines. At frequent intervals these tunnels would be connected by cross passages with air-tight doors, rendering it easy to introduce currents of air, and to exchange workmen from one tunnel to the other. Including the junctions with the main lines of railway in England and France, the total length of each tunnel would be 31 miles, the actual length under water being 24 miles. The tunnels would be placed 36 ft. apart, and lined throughout by cast-iron segments, of ample strength to resist any possible pressure, and grouted on the outside so as to secure a covering of cement, which would not only prevent leakage into the tunnels, but also preserve the plates from corrosion.

Assuming that 17 yards per day could be excavated for six days per week, the annual progress would be about three miles at each face, so that the driving of the drainage heading would occupy four years. Three shifts of men would have to be employed, and the changing would take place below and on the spot, no stoppage of work being allowed. This was the system adopted in the case of the Simplon Tunnel, where the drills never stopped while the shifts were changing. An emergency door would always be kept in position near the face of the heading, not so much for actual use, but rather to induce confidence in the minds of the men at work. The drainage heading would be commenced and driven at as high a speed as was found to be practicable, it being a matter for the directors to decide whether this should be completed before proceeding with the main tunnels, or whether they should be carried forward at the same time. It would be necessary to keep an efficient supply of air throughout the entire length of the heading for the men employed. This could be best effected by bratticing-off the upper portion of the heading, thus forming a conduit of the required size for the volume of air, which would be blown in by high-speed fans. Such would be the primary ventilation, and permanent ventilation of the main tunnels would be established by blowing air in the direction in which each train was travelling. The traffic being electrically operated, the volume of air required was much reduced. To keep the tunnels pure and fresh, it would be necessary to supply 45,000 cubic feet per minute on each line of way, travelling at a velocity of 6 ft. per second, which was equivalent to a light breeze. The power required to induce this current of air, much assisted as it would be by the trains, would not be large, and the entire problem was simple as compared with that in many collieries through which not only were far greater volumes of air blown in order to deal with explosive gas, but the length of passages through which the air had to be driven or exhausted was considerably greater, and impeded by bends which would not exist in this case.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

CURRENT LITERATURE.

Iron Ore in Chile.—At the September meeting of the Iron & Steel Institute, C. Vattier and N. Echegarai presented a paper on the iron ore resources of Chile, in continuation of one read before the same society a year ago.

Extra-lateral Rights.—The *Engineering and Mining Journal* of September 20 contains an excellent article by J. B. Clayberg on the 'Extra-lateral Rights to Quartz Veins,' describing all the conditions under which such rights may exist as determined by the court decisions.

Measuring Temperatures of Coal.—At the September meeting of the Institution of Mining Engineers, T. F. Winnill described an electric-resistance recording thermometer for registering the variations of temperature in stored coal. The same instrument would prove useful in ascertaining rock temperatures in deep metal-mines.

The Cobalt Area.—The *Canadian Mining Journal* beginning with August 15 reprints Willet G. Miller's paper on the geology of Cobalt, Ontario, read at the International Geological Congress.

Pumping at the Comstock.—In the *Mining and Scientific Press* for August 23, A. M. Walsh describes the electric pumps used at the Comstock mines, where the water is exceptionally hot and charged with alum and acid.

Bolivian Tin.—The *Bulletin* for September of the American Institute of Mining Engineers contains a paper on the 'Tin Situation in Bolivia,' by Howland Bancroft. The paper is chiefly a compilation intended to draw attention in America to Bolivian tin.

Hoisting by Compressed Air at Anaconda.—The September *Bulletin* of the American Institute of Mining Engineers contains a paper by Bruno V. Nordberg describing the system of hoisting at Anaconda by compressed air, the latter being produced in electrically-driven compressors.

BOOKS REVIEWED

Cecil Rhodes : The Man and His Work. By Gordon Le Sueur. Cloth, octavo, 350 pages, illustrated. London : John Murray. Price 12s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

It is with mixed feelings that we read this book. Rhodes' relations, friends, and associates can hardly regard the book with complacency, and even Afrikaners and Englishmen who had reason to doubt the sincerity of his statesmanship would prefer that the faulty side of his character should be allowed to assume an inconspicuous position within the shadows of time. The author was for many years his private secretary, and with a man of Rhodes' temperament, a secretary's duties covered a vast range, from lighting his cigarettes to providing egg-laying hens for his voyages between Great Britain and the Cape. It is obvious therefore that Mr. Le Sueur had a thoroughly intimate knowledge of Rhodes' bent of mind, and his method of dealing with his business associates and his political friends and opponents. So we have vivid pictures of his life at Grootte Schuur and on the veldt, and of his treatment of the board of directors of the De Beers company. But the author is distinctly maladroit in many of his efforts, if efforts they be, to remove misunderstandings on the part of the public in connection with his late chief's character. For instance, in combating the belief that Rhodes was a hard drinker, he says that "he liked his champagne in a

tumbler, and at lunch or dinner had a habit of tossing off the glass absent-mindedly. After meals he would have his favourite Russian kummel of which he would often have five or six liqueur glasses in the course of after-dinner conversation." "He was fond of a mixture of champagne and stout in the forenoon," etc. The story of Rhodes' fatal entanglement with the Princess Radziwill is also unsatisfactory, for it tells either too much or too little. The anecdote about his upsetting Barnato's carefully classified diamonds so as to gain the few weeks required for re-sorting and thus to perfect his own scheme, does not stamp Rhodes as an exponent of the highest class of finance. His treatment of Sir Henry de Villiers, asking him if he would be prepared to form a ministry and to submit names of proposed ministers, when he only wanted ideas and did not intend that anyone but himself should be premier, does not reflect the most honorable type of statesmanship. Altogether, Mr. Le Sueur's book suggests the unscrupulous, rather vulgar bargainer, more at home in negotiating commercial deals than a statesman winning the confidence of his country at home and in Africa. The fact that the Rhodes trustees have destroyed the correspondence in connection with the obtaining of concessions from Lo Bengula leaves an unpleasant impression. It is generally known of course that he lost the confidence of the Boer members of the Afrikaner Bond through not opening Rhodesia to burghership, but instead giving huge slices of the new country to his various English supporters, most of them connected with the Stock Exchange. His judgment was woefully wide of the mark when he supposed that Kruger would not fight. In earlier days the Bond believed in him, for they knew him as a strong and fearless Englishman bent on the development of the country. Had he possessed a graciousness of demeanour and a sincerity of promise, he could have formed a United South Africa, and have avoided the bloodshed of 1900. Not only so, but a larger proportion of the continent would have come under British sway and the Transvaal and Rhodesia would have had better access to the sea at Delagoa Bay, Beira, and Benguela. It is an ungrateful task to record these reflections, aroused by the perusal of the book. We would prefer that Rhodes' memory had been perpetuated in the glamour of romance.

E.W.

General Metallurgy. By H. O. Hofman. Cloth, octavo, 910 pages, with many illustrations. New York : McGraw-Hill Book Co. Price 25s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

It is recorded that, on a certain occasion, Daniel whose name was Belteshazzar, was "astonied for one hour." Probably the average technologist will suffer a similar mental strain when he first turns over the pages of Professor Hofman's new book, for the infinity of detail contained in it obscures the general scope, and makes it difficult to grasp the aim and system of the author. For this reason the task of the conscientious reviewer is no easy one. In his case the 'hour' of the quotation might well be a 'month' or even a 'year.' The first point to which attention is to be drawn in describing this book is that the word 'metallurgy' is used in its etymological sense, and includes everything connected with the working of metals, not being restricted to the extraction of metals from their ores. Secondly, the volume is intended as an introduction to a series of books devoted to special branches of the art. Four such are at present in course of preparation, dealing with copper, lead, iron and steel,

and the minor metals. It is also necessary to note that Mr. Hofman is not carrying the whole of the responsibility on his own shoulders, and that he acknowledges his indebtedness to many friends and colleagues, the best known on this side being J. W. Richards and R. H. Richards, authorities respectively on metallurgical calculations and ore dressing. It is not necessary to introduce Mr. Hofman to our readers, for he is well known as the professor in the Massachusetts Institute of Technology at Boston, and as the author of the 'Metallurgy of Lead,' while of recent years he has published the results of a great variety of researches in connection with furnace reactions.

The first three chapters of the book are devoted to the branch of study usually included under metallography, that is to say the properties and structure of metals, and the formation and properties of alloys. Then follows a chapter on the metallic compounds, oxides, sulphides, salts, etc., the temperatures of their formation, dehydration, etc. Chapter 5 is headed 'Ores' and consists of a single page, including Kemp's definition and Krusch's formula for the smelter's valuation. The section on fuel occupies 230 pages, and is in itself a compact treatise on coal, coke, petroleum, and gaseous fuel, their calorific values, and the mechanical means of utilizing their heat. Refractory materials are treated in 40 pages. The remaining 500 pages are divided into four sections devoted to pyrometallurgical, hydrometallurgical, and electrometallurgical processes and apparatus, and mechanical metallurgical operations. Of these, the last named occupies by far the largest amount of space, and in fact constitutes the chief novelty of the book. It is here that many technologists will find on first sight an inclination to disagree with the author for apparently exceeding the legitimate bounds of metallurgical problems. On more mature consideration, however, they will probably appreciate the convenient way in which the author chooses the salient points of these collateral subjects in their immediate application to the metallurgist's requirements. The section is divided into four sub-sections, dealing with ores, metals, liquids, and gases. In the sub-section devoted to ores, he describes the methods and machines used in comminuting ores, and classifying and concentrating them. The part devoted to metals describes the work done by rolling-mills, steam hammers, forging presses, and wire-drawing plant. That devoted to liquids describes pumps of all sorts, air-lifts, agitators and mixers, and filters of various types. The consideration of gases covers a wide field draft, natural and forced, fans, blowers, hot blast, drying by refrigeration, regenerative furnaces, smelter smoke, removal of fume and noxious gases, and many other topics are described in detail.

We like Mr. Hofman's concise style. The absence of verbosity and the careful prearrangement of sequence enables him to compress a vast amount of useful detail into his pages. His references to special books and articles are eclectically chosen and are adequate. In this way the book differs from many in which the profusion of reference induces a weariness of mind. Moreover Mr. Hofman's outlook is world-wide; he draws inspiration from European experience. In this way he presents a contrast to the author of another book conceived on similar lines, who stated that American practice was good enough for him. Thus Mr. Hofman's volume forms a reliable work of reference in connection with general metallurgy, and as such will find a place in the libraries of our technologists. Finally we have a word of commendation for the excellent tabular matter and for the illustrations.

E. W.

Cobalt Nickel Arsenides and Silver Deposits of Temiskaming. By Willet G. Miller. Paper covers, octavo, 280 pages, with many maps and illustrations. Ottawa: Department of Mines.

This excellent monograph by Willet G. Miller on the geology and ore deposits of the Cobalt area has been brought up to date and issued as a fourth edition. Its appearance is welcome, for the 1908 edition has been out of print for some time. Mining operations during the last few years have disclosed many new features, and our knowledge of the geology of the district has been distinctly advanced. The book also gives information about outlying districts such as Gowganda, South Lorrain, Casey, Shining Tree, etc., of which much is now heard on this side. Chapters are included dealing with other deposits of cobalt ores, the metallurgy of cobalt, and the methods of mining and concentrating the ores found at Cobalt. The new maps and diagrams are highly illuminating. We would here draw attention to the paper presented by the author at the International Geological Congress, giving the latest information relating to these ore deposits. It is being reprinted in *The Canadian Mining Journal*.

Mercury in New South Wales. By J. E. Carne. Paper boards, octavo, 55 pages, with maps. Sydney: Department of Mines. Price 2s. 6d. net.

This is the second edition of one of the monographs issued by the New South Wales Government. Mercury ores are found in various parts of the state, but development has been confined to the deposits at Cudgong, Yulgilbar, and Pulganbar. The ores have proved to be of too low grade for direct treatment, and concentration was unsatisfactory. Mr. Carne's book gives much information relating to the deposits.

Coal and the Prevention of Explosions and Fires in Mines. By John Harger. Cloth, octavo, 186 pages illustrated. Newcastle-on-Tyne: Andrew Reid & Co.; London: Longmans, Green & Co. Price 3s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

During the last few years close study has been made of the physical constitution of coal, not so much for paleontological reasons, but with the object of ascertaining the nature of the alterations induced by mining operations. In what way is the occluded gas released; how do fires originate in the refuse coal stacked in the gob or worked-out part of the mine; what is the prime cause of explosion, gas or dust? are a few of the questions now receiving attention. Mr. Harger is a foremost authority on these subjects, and his book discusses the problems clearly.

Gas Testing and Measurement. By Charles Chandley. Small octavo, 80 pages, illustrated. London: Methuen & Co. Price 1s. 6d.

This little book describes the methods of testing gas in coal mines, and gives the rules for calculating the flow of air-currents. It is intended for students qualifying for certificates under the Coal Mines Act.

Introduction to the Study of Igneous Rocks. By George Irving Finlay. Leather, octavo, 230 pages, with tables and illustrations. New York: McGraw-Hill Book Company. Price 8s. 6d. For sale at the Technical Bookshop of *The Mining Magazine*.

The author is assistant professor of geology in the New York University, and the object of his book is to present to students a convenient guide to the microscopical study of the igneous rocks.

COMPANY REPORTS

Broken Hill Proprietary.—The report of the premier company at Broken Hill, New South Wales, for the half-year ended May 31 last shows that 120,568 of ore was raised from the mine, and 116,020 tons was sent to the dressing plant, where 24,074 tons of lead concentrate was recovered, averaging 58% lead and 26'35 oz. silver per ton. This plant also treated 113,409 tons of old dump tailing, from which was obtained 3289 tons of concentrate averaging 51'58% lead and 26'83 oz. silver per ton. The flotation plant treated 167,827 tons of zinc tailing, and recovered 41,771 tons of zinc concentrate assaying 46% zinc, 7'3% lead, and 12'93 oz. silver per ton. The flotation plant for treating slime was not in use during the period, as there is on hand a large stock of slime concentrate waiting for treatment in the smelting plant. Three lead furnaces were in continuous use, and treated 2916 tons of oxidized ore, 83,190 tons of concentrate and slime, and 2036 tons of residue from the zinc furnaces, a large part of the material being purchased. The yield was 41,819 tons of bullion. The refinery treated 42,363 tons of bullion, yielding 41,181 tons of soft lead, 335 tons of antimonial lead, 2,167,956 oz. silver, and 619 oz. gold. In the zinc-distilling plant, 5 furnaces were at work at the beginning of the period, and the number was increased to 8 when the cooler weather arrived. The output was 1475 tons of spelter and 203 tons of blue powder. The capacity of the 8 furnaces is approximately 90 tons of spelter and 12 tons of blue powder per week. The net profit for the year was £124,191, out of which £120,000 was distributed as dividend. The report states that the iron and steel venture is progressing. An additional quarry is being opened at the Iron Knob mine and crushers erected. The foundations for the blast-furnaces at Newcastle are completed, and delivery of the structural steel is awaited. Dredging is being done in order to improve the harbour facilities.

Broken Hill South Silver.—The report of this company for the half-year ended June 30 shows that the output and profit were reduced owing to 3-weeks stoppage during the railway strike at Broken Hill in April. The amount of ore raised was 151,836 tons averaging 14'4% lead, 13'7% zinc, and 6'5 oz. silver per ton. The largest proportion came from the 970-ft. and 1070-ft. levels. The yield of lead concentrate was 24,417 tons averaging 70'2% lead, 6'7% zinc, and 22'7 oz. silver per ton. The amount of zinc tailing produced was 109,098 tons averaging 2'9% lead, 15'5% zinc, and 2'9 oz. silver per ton, and of slime 16,814 tons averaging 9'3% lead, 13'3% zinc, and 6'7 oz. silver per ton. The zinc tailing was delivered to the Amalgamated Zinc (De Bavay's) together with 20,809 tons of accumulated tailing. As regards the slime, of which there is an accumulation of 330,000 tons, experiments show that a profit can be made, and the directors promise an announcement on the subject shortly. The exploration of the southern portion of the property is giving satisfactory results. The working cost rose to 22s. 7d. per ton, as compared with 19s. 3d. during the previous half-year, owing almost entirely to the strike. The contract workers earned 19s. 9d. per shift of 8 hours on development work, and 16s. 1d. on stoping, while shovellers earned from 12s. 8d. to 13s. 8d. per shift. The average daily attendance of men was 356 on the surface and 787 underground. The company has on hand 965,925 tons of zinc tailing awaiting delivery to the Zinc Corporation, averaging 5'6% lead, 16'4% zinc, and 3'6 oz. silver per ton. The accounts for the half-year show an income of

£268,540 from the sale of lead concentrate and £30,474 from the sale of zinc tailing. The dividends absorbed £160,000.

North Broken Hill.—This company was formed in 1895 in Melbourne to acquire property at the north end of Broken Hill, New South Wales. It was reconstructed in 1905, and at the end of last year the capital was expanded from £200,000 to £600,000 by issuing three £1 shares in place of one. The company owns one of the most promising mines in the district. The control is with the Baillieu group, and George Weir is manager. The report now issued covers seven months from the last re-organization on December 1, 1912, when the capital was expanded. During this period, 159,583 tons of ore was raised, mostly from the 950-ft., 1100-ft., and 1250-ft. levels, the average content being 15'8% lead, 13'3% zinc, and 7'2 oz. silver per ton. In the concentrating plant, this ore yielded 26,503 tons of lead concentrate, averaging 69'6% lead, 6'6% zinc, and 22'2 oz. silver per ton. The other products were: zinc tailing 73,661 tons, averaging 3'7% lead, 18% zinc, and 3'8 oz. silver per ton; slime 14,627 tons, averaging 14'1% lead, 15'6% zinc, and 9'4 oz. silver per ton; and 38,889 tons of quartz tailing, averaging 2'8% lead, 8'3% zinc, and 2'4 oz. silver per ton. The zinc tailing was sold to the Amalgamated Zinc (De Bavay's) company. The accounts show receipts £302,730 from the sale of concentrate, tailing, and slime, and a working profit of £155,070. The amount of £56,000 has been placed to reserve, and £12,000 to income-tax requirements. The shareholders receive £60,000 on the capital £600,000. The working cost was 18s. 7½d. per ton of ore raised. Labour has not been so scarce as during the last year or two, but wages are high, the average wage paid to contract miners having been 18s. 7d. per day and to shovellers 14s. 10d. per day.

Nourse Mines.—The report of this company, belonging to the Rand Mines group and operating mines in the eastern part of the Central Rand, covers the 11 months ended June 30 last, an alteration being made so as to make the annual period commence with the mid-year. The ground in these mines is much broken by faults and dikes, and during the year under review, for this reason, the amount of ore developed was not equal to the amount raised; 27,805 ft. of development was done, revealing 512,700 tons of ore, as compared with 683,062 tons raised. The reserve on June 30 was estimated at 1,795,600 tons, averaging 6'6 dwt. or 27s. 9d. per ton. As regards the ore developed during the year it is interesting to note that the Main Reef averaged 40 in. wide and assayed 39s. 6d. per ton, the Main Reef Leader 12 in. wide and 108s. 1d., and the South Reef 19 in. and 82s. 9d. The stoping widths are estimated at 64 in., 45 in., and 49 in. respectively. During the 11 months, 683,062 tons of ore was raised, and, after the rejection of 15½% waste, 577,200 tons was sent to the mill, which contains 260 stamps and 7 tube-mills. The yield of gold by amalgamation was 152,749 oz., and by cyanide 54,460 oz., being a total of 207,209 oz., worth £870,581, or 30s. 2d. per ton milled. The working cost was £615,850 or 21s. 4d. per ton milled. The yield was 4d. per ton less than during the previous period, and the working cost was 1s. 2d. less. The working profit was £254,731, or 8s. 10d. per ton milled. In addition a profit of £5777 was made by the treatment of 12,476 tons of accumulations, while on the other side £16,262 was spent on capital account. The electrification of the plant has not yet been completed owing to the inability of the power company to meet requirements, so both electric and steam plant are still in use. It is the same case with

the compressed-air supply. The re-organization of the underground haulage and hoisting to the surface is well in hand. Ventilation is stated to be satisfactory, and the water-supply system is sufficient for the prevention of dust. The systematic control of the times for blasting has done much to improve underground conditions. B. Madew is consulting engineer and R. A. Barry manager.

New Modderfontein.—This company belongs to the Rand Mines group, and was formed in 1888 to acquire property in the far east Rand. Milling commenced in 1892 with 10 stamps. The first dividend was paid in 1907. The capital and the scale of operations have been gradually expanded. The most recent addition to the capital was in 1910, when 50,000 shares

advanced from 18s. 8d. to 19s. 11d., partly on account of the scarcity of labour, but chiefly because, by the improved system of accounting, a larger proportion of current expenses has been charged to revenue account. On the other hand, ore of higher grade than the average of the mine has been extracted, the yield per ton milled being 39s. 7d., as compared with 34s. 6d. the year before and 29s. 5d. during the year ended June 30, 1911. The ore reserve on June 30 last was 4,547,000 tons, averaging 34s. per ton. The total ore mined during the year was 609,378 tons, and after the rejection of 7% waste, 565,400 tons, assaying 40s. 9d. per ton, was sent to the mill. The yield by amalgamation was 199,671 oz. and by cyanide 66,553 oz., or a total of 266,224 oz., being at the rate of 39s. 7d. per



SKETCH PLAN OF NEW MODDERFONTEIN WORKINGS.

of the nominal value of £4 were offered at £11 each, bringing the total issued capital to 350,000 shares of £4 each, the money thus raised to be used in sinking a new vertical shaft. The present metallurgical equipment contains 180 stamps and 7 tube-mills, having a capacity of 52,500 tons per month. Development has been done almost entirely from four shafts situated along the northern border of the property. At present work is concentrated on No. 2 and No. 12 shafts, and the 8th level is used for main haulage. The new circular vertical shaft has been sunk toward the southern side of the property, and in October last it intersected the deposit at 2158 ft. A connection is to be made between No. 12 and the circular shaft. The report for the year ended June 30 last shows that owing to the fluctuating supply of native labour, the tonnage milled decreased by 20,500 tons as compared with the previous year, the figure being 565,400 tons. The cost per ton

ton milled. The value of the gold was £1,119,171, and the working cost was £563,086, leaving a profit of £556,084. In addition, a profit of £3158 was made by the treatment of 24,030 tons of accumulated slime. Out of the profit, £54,848 was paid as tax and £17,310 was the yearly payment to government in respect of certain undermining rights. The shareholders received £420,000, being at the rate of 30%.

Pena Copper Mines.—This company was formed in 1900 to acquire a copper and sulphur mine in the Huelva district, in the south of Spain, that had previously been worked by a Belgian company. After the finances and methods of management had been re-organized, the payment of dividends was commenced in 1903. Five per cent was paid for that year on the issued capital of £537,600. For the next three years the dividends were at the rates of 5, 4, and 7½% respectively. During 1909 special expenditure out of

income was incurred in connection with the removal of overburden, and in 1910 and 1911 the profits were conserved owing to the legal proceedings started by the Rio Tinto company in connection with the contract for marketing the products, and also for the provision of capital required for building a branch railway that would make the company independent of the Rio Tinto company's railway. Three years ago it was decided to sell a larger proportion of ore for export and to treat less on the spot for the production of copper precipitate. The report now issued covers the year 1912, and shows that the output has been curtailed pending the completion of the company's new railway. The ore mined was 84,698 tons, as compared with 131,367 tons during 1911; of this, 40,843 tons was sent to the leaching floors, and 43,854 tons exported. The shipments totalled 80,844 tons, of which 20,201 tons was cupreous ore, 35,218 tons non-cupreous ore, and 25,425 tons washed ore. The precipitate produced

American Oroville company advanced the working capital and is responsible for the management, as it is also for the management of the Oroville properties. The report now issued by the English Oroville company covers the 21 months ended June 30. As no dividends have been received from the American company, the balance sheet is of no interest. Attached to the report are two sets of balance sheets of the American company for the year ended July 31, 1912, and for the 6 months ended January 31, 1913, respectively, a report by W. P. Hammon on the operations of the American company at Oroville during the 18 months ended January 31, 1913, and on the progress at Pato, and a report by Theodore J. Hoover on the prospects of the Oroville and Pato properties.

The operations at Oroville during the 18 months ended January 31, 1913, were confined to the Boston & Oroville, Boston & California, and Oroville Exploration sections of the consolidated properties. The

RESULTS OF DREDGING AT OROVILLE DURING 18 MONTHS ENDED JANUARY 31, 1913.

COMPANY.	Cu. Yd. Eucavated.	Average Depth Feet.	Acres Dredged.	CURRENT EXPENSE.				Smelting & Express Charges.
				Labour & Material. \$	Electric Power. \$	Water. \$	Repairs. \$	
Boston & Oroville	1,769,112	35'8	30'62	21,162'21	13,239'00	1,199'70	32,765'74	593'00
Boston & California	766,763	35'7	13'55	19,329'01	10'932'60	3,600'00	25,401'86	331'58
Oroville Exploration	4,526,653	28'3	99'06	54,765'58	29,126'06	2,400'30	75,186'53	1,776'34
Totals and Averages	7,062,528	30'5	143'23	95,256'80	53,297'66	7,200'00	133,354'13	2,700'92

COMPANY.	General Expenses. \$	Taxes and Insurance. \$	Total Expense. \$	Total Cost Cu. Yd. c.	Gross Bullion Returns. \$	Returns per Cu. Yd. c.	Profit \$	Profit Cu. Yd. c.
Boston & Oroville	9,052'33	6,596'45	84,608'43	4'78	158,604'83	8'96	73,996'40	4'18
Boston & California	9,859'05	3,351'78	72,805'88	9'49	77,968'37	10'16	5,162'49	0'67
Oroville Exploration	28,165'07	9,709'76	201,129'64	4'44	489,728'88	10'81	288,599'24	6'37
Totals and Averages	47,076'45	19,657'99	358,543'95	5'07	726,302'08	10'28	367,758'13	5'21

during the year contained 793 tons of fine copper. After charging £4401 depreciation, the trading profit for the year was £34,163, out of which £7365 was paid as administration expenses and taxes, and £1045 as debenture interest; £12,000 debentures were redeemed, and the balance £13,752 carried forward. The outstanding debentures now amount to £8900.

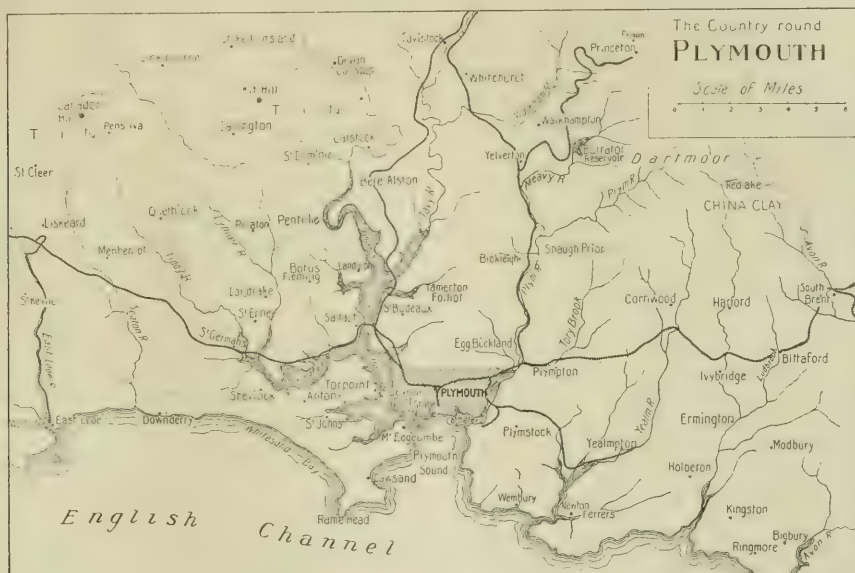
At the meeting of shareholders it was stated that the orebody was found to be faulted at the 12th level, but nevertheless the developments have been satisfactory, as the ore reserve has been slightly increased, being 3,974,461 tons at the end of 1912 as compared with 3,850,000 tons the year before. Since November last, when the contract with the Rio Tinto company expired, no shipments have been made. The new railway is approaching completion, four-fifths of the track having been laid.

Oroville Dredging.—A company of this name was formed in America in 1905 to consolidate a number of gold-dredging interests in California. As practically all the shares were held on this side, an English company was formed in 1909 to acquire the whole of the shares of the American company. This exchange of shares has only been completed as far as English holders are concerned, and some outstanding shares in the American company are still in the hands of the original American holders. In the same year the Pato dredging property in Colombia was acquired by a separate English company formed for the purpose. The

fourth section, the Bear River, has been proved unprofitable and was abandoned, and the No. 2 dredge dismantled. The table reprinted herewith gives details of the output, cost, and profit. Out of the profit of \$367,758, \$21,969 had to be paid for the London agency, and \$15,480 was added as profit from the machine shop. After the adjustment of several small items, the net balance of profit was \$357,403. From this, \$60,808 was written off for the dismantling of dredges. As regards the Pato property, \$986,278 has been advanced on loan by the American Oroville company out of its profits for the purpose of supplying a dredge, building a dam, etc., a figure double the original estimate. Mr. Hoover in his report describes the various dredges and shows that they are rapidly coming to the end of their existence. Five were at work at the beginning of 1913, but at the end of the year it is probable that only two will be left. He estimates that the ground will be exhausted in 6 years, during which time a profit of £100,000 may be expected. These figures are based on personal examination. In dealing with the Pato property, he adopts the engineer's original estimate of a profit of £350,000, spread equally over 7 years. He is hopeful that the profitable area will be extended, seeing that some of the supposed barren ground through which the dredge has had to cut its way from the point of erection to the tested ground has yielded gold at the rate of 35 cents per cubic yard.

China Clay Corporation.—This company was formed by L. Ehrlich & Co. in the early part of 1910 to acquire and develop a china-clay deposit at Redlake, in the southern part of Dartmoor, Devonshire. E. T. McCarthy is a member of the board of directors, and John Mutton is manager. The report for the year ended June 30 shows that delay in starting production has been caused by the faulty construction of the pipeline intended for conveying the clay from the pits to the refining works at Cantrell. Action is being taken against the contractor, and the work is being done by the company's staff instead. The engines and pumps are at present being delivered and their erection should be completed shortly. The railway siding from Bittaford to Cantrell has been ready for some time. Mr. Mutton in his report states that the main pumping shaft has been sunk to a depth of 130 ft. For the first 95 ft. it measures 10 ft. 6 in. by 7 ft. 6 in. inside timbers, and for the remaining 35 ft. it is widened to

mines between Kyshtim and Orsk. The control is in the same hands as the Kyshtim Corporation. The capital is £300,000, of which £190,000 is represented by the shares of the Russian company; in the balance sheet at December 31 last, £73,011 is shown to have been advanced in cash as working capital to the Russian company, and £37,999 cash remaining in hand. The latter has been spent since then, as well as other money advanced on loan. It is now proposed to issue additional shares of the Russian company and for the Tanalyk Corporation to subscribe for the whole of them. A debenture issue of £200,000 is to be made, and £200,000 new shares are to be created. Of the shares, 66,000 will be held against conversion of the debentures, and 50,000 placed under option to the Inter-Russian Syndicate, otherwise Messrs. Beatty and Hoover, at £3 per share until November 1916. The yearly report now issued contains a statement, checked by R. Gilman Brown, of the various properties and



22 by 11 ft. It passes through hard granite. An adit for the conveyance of the raw clay in suspension has been driven to the clay ground. This adit is 270 ft. long, 6 ft. high, and 4 ft. wide. For 150 ft. from the pumping shaft the adit is in granite, and afterwards it passes through clay, where it is close-timbered with 8 by 8 in. sets and 7 by 2½ in. lagging. From the further end of the adit a rise has been cut to the surface through 100 ft. of clay. This rise acts as a washing-shaft. The clay and water will be elevated through the pumping shaft and delivered in 15 in. steel pipes to the dressing plant, and the refined clay gravitated subsequently through stone-ware pipes to driers at Cantrell, 8 miles away. The clay developed is reported to be of excellent quality. The issued capital of the company consists of 150,000 ordinary shares credited as fully paid and issued to the vendors, and 120,000 preference shares on which 17s. 6d. per share has been called up. The above map shows the position of the property.

Tanalyk Corporation.—This company was formed in April 1912 for the purpose of purchasing the entire share capital of the South Urals Mining and Smelting Co., a Russian organization owning copper and other

their present state of development. The most important mine is the Mambet, which is being developed in two sections. The workings are down to 165 ft., and the lode has been found to average 10 ft. The ore assays from 2 to 3% copper and about 8 dwt. gold and 10 oz. silver per ton. These figures are not exact, but are intended to indicate an average of those in the report, which show considerable variation. The developments at the Tanalyk have not given such good results; two veins 3 ft. wide have been found, averaging 2 to 3% copper, 3 to 4 dwt. gold, and 2 oz. silver. Lower grade ore is found at the Troitsk shaft, useful as a flux for mixing with the other ore. The estate belonging to the company contains timber and coal. A seam of coal 7 ft. thick has been disclosed in a prospecting pit 22 ft. deep, and it promises to yield a fuel suitable for metallurgical operations. Early this year, it was recorded in the Magazine that the presence of zinc in the ores was causing anxiety. It is now stated that no difficulty will be caused in this direction. A smelting plant to produce 1500 tons of copper per year is now in course of erection. The first half should be in operation early in 1914. It is estimated that the copper will contain 14 oz. gold and 244 oz. silver per

ton. The average content of the ore reserve, figured by Mr. Gilman Brown at 70,000 tons, is given as 2.9% copper, 7.4 dwt. gold, and 7.5 oz. silver.

Lake View & Oroya Exploration.—This company was constituted in November 1911 by the absorption of the Oroya Exploration company by the Lake View Consols. The latter company had previously handed its Kalgoorlie properties to the Lake View & Star, and the former its properties in the same district to the Oroya Links. The object of this rearrangement was to separate the Kalgoorlie assets, and to form an exploration and development company ready for operations in any part of the world. F. A. Govett is chairman and H. C. Hoover managing director, while Bewick, Moreing & Co. are general managers in West Australia. The company is operating the Queen of the Hills mine in West Australia, and holds preponderating share interests in the Lake View & Star, Yuanmi, and Mountain Queen companies. Other large holdings are in Zinc Corporation, Oroya Leonesa (Nicaragua), Granville Mining (Yukon), and Burma Mines. The accounts for the year ended June 30 show an income of £67,108 from interest and dividends, £5975 from the re-treatment of old tailing at Lake View Consols, and £6962 as profit on the working of the Queen of the Hills mine. The net profit was £76,771, out of which £36,095 has been distributed as dividend, being at the rate of 10%, and £40,000 has been placed to reserve. As announced a year ago, it is the policy of the company to accumulate a large cash reserve, to be devoted to the acquisition and development of new properties and to the expansion of work by the present subsidiaries.

Mount Bischoff Tin.—The half-yearly report of the leading tin mining company in Tasmania for the period ended June 30 shows that 106,063 tons of ore was sent to the stamps, and that the yield was 580 tons of concentrate. These figures compare with 117,328 tons of ore and 600 tons of concentrate for the previous half-year, the fall being due to a stoppage of the plant during the dry weather. The smelter treated 1644 tons of concentrate, of which 588 tons was the produce of the mine and 1056 tons custom material. The yield was 1117 tons of metallic tin, of which 373 tons was from the company's concentrate and 744 tons from the custom ore. The working cost at the mine was 5s. per ton of ore, as compared with 4s. 8d. during the previous half-year. The net profit for the period was £41,631, out of which £36,000 was paid as dividend, and £2571 for income tax. The amount of £5906 was written off the plant and property account. The profit for the previous half-year was £49,798 and the dividend £39,000. Since the commencement of operations in 1873, the total distribution has been £2,704,000 on a paid-up capital of £29,600.

Kampong Kamunting Tin Dredging.—This company has been formed by Messrs. Pratten and Freeman, in Sydney, New South Wales, to acquire a tract of alluvial tin ground at Kamunting, three miles from Taiping, the capital of Perak, Federated Malay States. Among the engineers who have reported on the property is M. T. Nelves Bluck, who was recently the manager of the Tongkah Harbour Tin Dredging company, an Australian venture near the Malay district. The deposit consists of sandy gravel with comparatively little clay. Over 300 bores have been made, and from the information so gained 384 acres are estimated to contain 18 million cubic yards averaging 1½ lb. cassiterite per yard. The average depth is 30 ft. and the bottom is soft clay. The proposition is suitable for bucket-dredging. Two dredges with 7-ft. buckets are to be erected. The cost of working is estimated at

4½d. per yard. The capacity of each dredge is calculated at 75,000 yards per month, and the total output of the two dredges at 80 tons of cassiterite per month. The capital of the company is £150,000 in £1 shares, of which 80,000 shares is the purchase price, 50,000 shares are offered for subscription, and 20,000 held in reserve. The cost of installing the two dredges is estimated at £40,000.

Ipoh Tin Dredging.—This company has been formed in London to acquire a tin-gravel property 6 miles south of Ipoh, in the Kinta valley, Perak, Federated Malay States. Reginald Pawle is on the board, and M. T. Nelves Bluck is consulting engineer. H. D. Griffiths has made an examination. The property has been selectively mined by previous Chinese owners, and the ground is now suitable for bucket-dredging. The average depth of the deposit is 42 ft., and the total ground 11,306,240 cubic yards; 100 acres average 1½ lb. cassiterite per cubic yard, 40 acres 1½ lb., and 38 acres ¾ lb. It is proposed to build a dredge with 10-ft. buckets, capable of treating 100,000 cubic yards per month. The cost is estimated at 4½d. per cubic yard. The deposit consists of a sandy gravel and the cassiterite is very fine, so that the saving apparatus will have to be carefully regulated. The capital of the company is £90,000, of which £43,500 in shares and £7500 in cash is purchase price. The 46,500 shares offered for subscription have been underwritten.

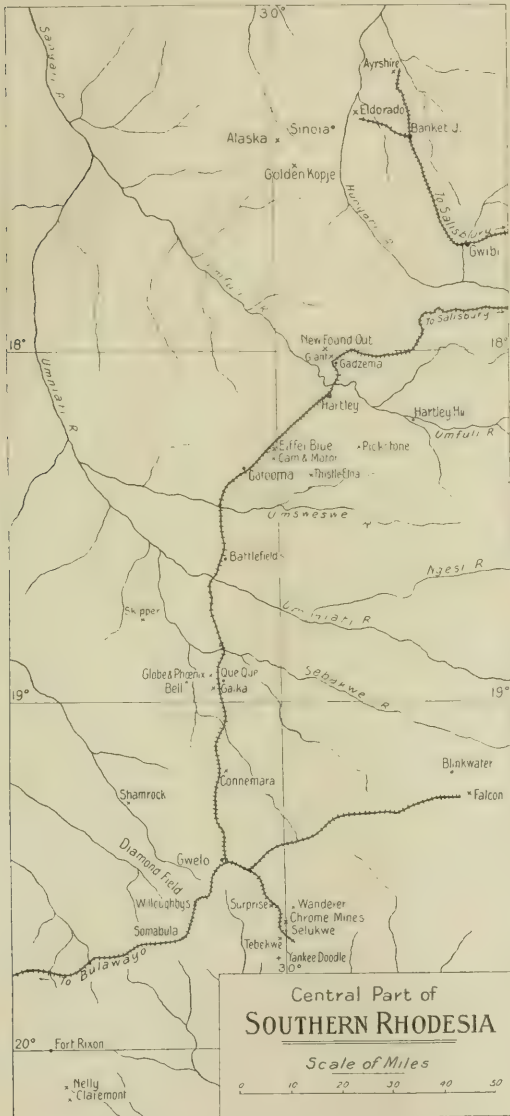
Rooiberg Minerals Development.—This company was formed under Transvaal laws in 1908 for the purpose of reopening ancient tin mines in the Rooiberg range of mountains, 40 miles by road from Warmbaths railway station, and about 75 miles northwest of Pretoria. The company was promoted by the Oceana Company, but within a short time the control passed into the hands of the Anglo-French Exploration group. Edward J. Way is the consulting engineer, and Edward R. Schoch is general manager. The original dressing plant, consisting of 10 stamps and concentrators, was superseded in May 1912 by a more modern plant containing 10 stamps, a tube-mill, and machines for treating slime. The report for the year ended June 30 shows that 21,742 tons of ore from the mine was sent to the mill, together with 14,175 tons of accumulated sand and slime. The average grade of the ore was 4.24% metallic tin, and of the accumulations 2.51%. The total yield of concentrate was 1196 tons, averaging 69.5% metal. The revenue from the sale of concentrate was £184,867, and the working cost was £96,674. Taxes absorbed £4035, directors' remuneration £3150, and £5535 was spent on capital account. The shareholders received £63,000, the dividend being at the rate of 35% on the capital, £180,000. The percentage of extraction during the year was 72.85%, as compared with 57.97% during the previous year when the old plant was at work. Mr. Way gives much information in his report as to the difficulty of securing average assays of the feed and tailing at the mill, in spite of the provision of automatic samplers, and he expresses the opinion that the figures given for the content and the percentage of extraction cannot be taken as absolutely accurate. He also deprecates the acceptance of the figures for the actual ore blocked-out, for he shows by reference to the records for the last four years that four times as much ore was eventually extracted as was indicated in the so-called reserve. His figures for the fully developed ore on June 30 last are 22,000 tons, averaging 5.32% metallic tin. Judging by previous experience, he adds 87,000 tons as probable ore. In addition, 30,300 tons of accumulated middling and slime remains to be treated, averaging 2½% metallic tin.

Bell Reef Development.—This company was formed in 1910 to acquire the Bell gold mine, in the Gwelo district of Rhodesia, a few miles to the west of the Globe & Phoenix mine. The property was first floated in London in 1895, and was subsequently worked on tribute. It is stated that the tributer won 36,000 oz. of gold from ore averaging 12 dwt. per ton. The mine was bought in 1910 by Abe Bailey and sold to the

in shares subscribed in cash. Since then £30,000 has been advanced in cash by the Gold Fields Rhodesian Development Co. for the purpose of continuing development work. This work consists of sinking a new vertical main shaft, to be used instead of the present inclined shafts. The lode was intersected at the 7th level by the new shaft and was found to assay 47 dwt. per ton over 34 in. The shaft is down to 876 ft., or 68 ft. below the 8th level. In addition to the sinking of this shaft, a small amount of development work has been done on the 5th, 6th, and 7th levels. The re-organized metallurgical plant is expected to be ready by December. No substantial addition has been made to the ore reserve during the year, and the figures still stand at 42,495 tons, averaging 12 dwt. H. A. Piper and A. J. Fraser are the engineers.

Oriental Consolidated.—This is an American company, formed in 1897 to acquire a gold-mining concession in northwestern Korea, or Chosen, as it is nowadays called. Henry C. Perkins is president and the Mills and Haggin groups have large holdings. English shareholders are represented by the Central Mining and Investment Corporation. The principal mines are the Tabowie and Taracol, and others are the Kuk San Dong, Chintui, Charabowie, and Candlestick. The report for the year ended June 30 shows that the output of gold was the largest on record. Though the amount of ore milled was rather less than during the previous year, the increased grade of the ore in the lower levels of the Tabowie and Charabowie more than compensated. The decrease in the amount of ore treated was caused by a smaller output at Kuk San Dong, temporary shortness of labour at Candlestick, and lack of water during the winter at Tabowie. The total ore treated was 312,818 tons, of which 112,529 tons came from Tabowie, and 93,558 tons from Taracol. The average assay-value of the ore was \$6 40 per ton. The yield was worth \$1,625,727 or \$5 19 per ton, being a recovery of 81%. The net profit was \$571,384, out of which \$429,390 has been distributed as dividend being at the rate of 10%. Since the commencement of dividends in 1903, the sum of \$4,932,910 has been distributed. The manager, A. Welhaven, reports that the developments during the year have been eminently satisfactory at the Tabowie and Charabowie mines, and the ore reserve has been substantially increased. The figures on June 30 were 805,900 tons averaging \$5 56 per ton.

Mexico Mines of El Oro.—This company owns a gold-mining property at El Oro, Mexico, containing part of the San Rafael vein, which continues through the Esperanza and El Oro mines. The property was originally acquired by the Mexican Gold & Silver Recovery Co. (the company formed to work the MacArthur-Forrest cyanide patents), but it was not until 1904, when the Exploration Company obtained an option, that any extensive development was done. Since 1908 the mine has been highly profitable. In 1910 the control passed from the Exploration Company to the French and Pearson interests, and the office of the company is now in Paris. Fergus L. Allan is manager, and Andre P. Griffiths consulting engineer. During the year ended June 30 last, the ore mined was 158,630 tons, an increase of 16,400 tons as compared with the previous twelve months. The 5th and 9th levels contributed to this total about equally, and smaller amounts came from the 3rd and 4th. Stopping has just been commenced on the 10th level. The average assay-value of the ore mined was 8 23 dwt. gold and 5 9 oz. silver. These figures are lower than those for the previous 12 months, when the average was 9 02 dwt. gold and 6 1 oz. silver. During the



present company. Last year the control passed to the Gold Fields Rhodesian Development company. Ten stamps and 2 Wheeler pans together with cyanide plant was acquired from the tributer. It was subsequently found that the ore at depth required roasting, and a new plant was ordered. No milling has been done since the end of 1910, and operations have been centred on development. The report for the year ended March 31 last shows that the issued capital consists of £100,000 in vendors' shares, and £81,338

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	Aug. 31 Tons	Sept. 30 Tons	Oct. 31 Tons
In England.....	16,829	15,134	13,278
In France.....	3,177	2,715	2,972
Afloat from Chile.....	2,300	1,225	1,350
Afloat from Australia.....	4,200	3,450	3,750
In Rotterdam.....	3,600	2,700	2,400
In Hamburg.....	2,138	1,121	1,079
In Bremen.....	1,801	1,475	998
In other European Ports..	900	1,100	1,550
Total European visible supply.....	34,945	28,919	27,377

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Production.	Deliveries			Stocks at end of month
		Domes- tic	Foreign	Total	
Total, 1911.....	639,258	316,791	337,009	653,800	—
Total, 1912.....	706,052	365,920	333,212	699,132	—
January.....	64,053	29,111	26,956	56,067	55,000
February.....	58,460	26,641	32,219	58,860	54,600
March.....	60,822	34,190	34,682	68,872	46,550
April.....	60,416	34,892	38,346	73,238	33,728
May.....	63,088	36,209	30,477	66,686	30,130
June.....	54,402	30,559	30,396	60,955	23,577
July.....	61,640	26,296	35,035	61,331	23,886
August.....	58,764	32,897	32,706	65,603	17,064
September.....	58,661	29,837	32,627	62,464	13,261
October.....	62,085	30,435	30,412	60,847	14,499

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
Year 1912.....	8,753,563	370,731	9,124,299	38,757,560
January 1913.....	760,981	28,409	789,390	3,353,116
February.....	702,394	31,728	734,122	3,118,352
March.....	760,324	30,228	790,552	3,358,050
April.....	755,858	29,116	784,974	3,334,358
May.....	761,349	32,957	794,306	3,373,998
June.....	716,267	30,810	747,077	3,173,382
July.....	625,107	30,282	655,389	2,783,917
August.....	697,686	30,410	728,096	3,092,754
September.....	676,411	29,775	706,186	2,999,686
October.....	687,515	30,916	718,431	3,051,701

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
Year 1912.....	25,486,361	29 2	19 3	9 18	12,678,095
January 1913....	2,296,948	27 11	18 0	9 9	1,113,579
February.....	2,100,137	27 11	18 3	9 9	1,019,774
March.....	2,321,254	27 5	17 8	9 8	1,121,786
April.....	2,301,099	27 6	17 11	9 7	1,101,099
May.....	2,366,726	26 11	17 7	9 4	1,099,397
June.....	2,177,354	27 6	17 8	9 9	1,061,507
July.....	1,873,980	27 6	19 4	8 3	785,263
August.....	2,162,807	27 1	17 7	9 6	1,026,851
September.....	2,035,318	27 9	17 10	9 10	1,002,228

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
January 31, 1913.....	300,090	9,780	13,912	222,791
February 28,	207,662	8,877	13,918	230,457
March 31.....	207,733	9,009	15,041	231,783
April 30.....	205,424	9,053	15,626	230,103
May 31.....	197,644	9,062	15,345	222,051
June 30.....	188,094	9,060	14,654	211,808
July 31.....	170,242	9,403	13,378	193,023
August 31.....	158,223	9,406	13,172	180,631
September 30.....	152,637	9,461	12,321	174,319
October 31.....	148,882	9,477	12,711	170,971

GOLD OUTPUT OF INDIA

	Year 1911	Year 1912	Oct. 1913	Year 1913
£2,150,050	£2,265,094	£194,314	£1,904,778	

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1910	1911	1912	1913
	£	£	£	£
January.....	227,511	207,903	214,918	220,776
February.....	203,888	203,055	209,744	208,744
March.....	228,385	231,947	215,102	257,797
April.....	228,213	221,296	221,476	241,098
May.....	224,888	211,413	234,407	242,452
June.....	214,709	215,347	226,867	241,302
July.....	195,233	237,516	240,514	249,302
August.....	191,423	243,712	239,077	250,576
September.....	178,950	225,777	230,573	250,430
October.....	234,928	218,862	230,072	—
November.....	240,573	214,040	225,957	—
December.....	199,500	217,026	218,661	—
Totals.....	2,568,201	2,647,894	2,707,368	2,162,478

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January.....	15,903	66,107	26,098	107,262	34,857	144,262
February.....	15,179	63,081	25,009	102,270	32,544	137,038
March.....	16,387	67,673	27,228	111,376	36,289	150,060
April.....	17,237	70,880	27,790	114,796	35,295	146,220
May.....	24,427	96,409	28,015	115,676	34,507	142,617
June.....	22,555	92,174	27,784	114,697	30,503	125,764
July.....	22,510	91,955	30,974	127,800	32,345	132,936
August.....	25,385	103,753	33,015	136,407	30,247	126,096
September.....	26,717	109,039	34,491	142,397	32,142	132,394
October.....	26,826	109,503	34,436	142,414	—	—
November.....	24,289	99,299	33,183	137,700	—	—
December.....	24,369	99,569	34,917	144,382	—	—
Totals.....	261,784	1,069,442	362,940	1,497,179	298,729	1,237,381

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910.....	363,496	1,209,856	1,573,352	6,682,042
Total, 1911.....	160,021	1,210,447	1,370,468	5,823,522
Total, 1912.....	83,589	1,199,080	1,282,669	5,449,057
January 1913.....	9,738	94,967	104,705	444,756
February.....	8,780	92,207	100,987	428,963
March.....	754	97,015	97,769	415,294
April.....	7,920	103,324	111,244	472,532
May.....	7,094	103,085	110,179	468,007
June.....	5,112	108,373	113,485	482,050
July.....	11,705	97,091	108,796	462,133
August.....	7,611	102,558	110,169	468,070
September.....	3,206	112,062	115,268	489,872
October.....	11,629	99,880	111,509	474,662

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	Oct. 1913	1913 to date
		£	£	
Victoria.....	2,138,000	2,039,400	134,800	1,521,700
Queensland.....	1,623,390	1,484,160	94,350*	851,430*
New South Wales	769,353	702,129	68,785	523,940
New Zealand.....	1,808,049	1,345,115	96,913	1,226,309

* September figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911.....	61514	£702,590	£114 4 5
Year 1912.....	64902	£831,908	£128 5 6
January to August, 1913	40413	£519,011	£128 8 3
September 1.....	2514	£25,493	£113 8 6
September 15.....	2514	£25,837	£110 13 8
September 29.....	235	£25,602	£108 19 0
October 13.....	2473	£25,815	£104 4 0
October 27.....	2378	£24,212	£106 8 6

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1912 tons	Oct. 1913 tons	1913 tons
Metal from Straits to Europe and America.....	59,036	5,025	51,718
Metallic Content from Bolivia to Europe.....	21,149	1,592	20,548

REVIEW OF MINING

INTRODUCTORY.—After the Balkan war comes the Mexican crisis. Just when a financial recovery was imminent, the markets are given another fit of nerves by the complications incidental to American intervention in Mexico. At the beginning of our month—which starts on the 15th day—the rapid succession of new flotations had induced an acute feeling of indigestion. The underwriters in the gilt-edged market had protested against a flood of demands for fresh capital, the position having been rendered serious by the utter failure of the New Zealand loan. Paris was in the midst of entanglements, and Berlin was uneasy. But real strength was shown in the oil and American departments. Then came a series of failures at Bombay and the Brazilian collapse, the latter due to the fall in rubber and coffee; and then, just when these troubles seemed to be overcome or discounted, the Mexican President takes the bit in his teeth and sweeps constitutional formalities to one side. The United States feels impelled to talk to him in a disciplinary way, and the fat is in the fire. A conflagration appears to be impending. The threat of this has intimidated the mining market. A decline has been hastened by the weakness in Paris, which holds large blocks of shares in mines that are on the down grade. On the Rand the scarcity of labour is affecting profits. In Rhodesia the same old game is being played, and the public is becoming wary. The Nigerian activity is largely that of brokers, not engineers. The Broken Hill group is strong on better methods of ore treatment and excellent developments in depth. In the Malay States a genuine expansion of mining exploitation is evident. We regard this as in many ways the most attractive field today. All Mexican business, of course, has wilted, but if the

United States ever acquires either police control or suzerainty over that unruly mining region, we shall see a notable diversion of capital and an extra-ordinary expansion of mining activity in the districts south of the Rio Grande.

TRANSVAAL.—The output of gold in October was worth £3,051,701, being an increase of £52,015 over September, but £213,449 less than in October last year. Labour statistics show no improvement; the decrease is 3755, as against a gain of 1319 in the corresponding month of 1912. The supply now amounts only to 148,882, as against 182,058 a year ago. This means a drastic decrease in development work.

The mining companies have finally agreed to recognize the Transvaal Miners' Association, and henceforth the mine managers will meet the officials of the Association when disputes arise between the management and its white employees. This is a formal bow to the inevitable.

The experience of the Crown Mines exemplifies the acuteness of the labour shrinkage. In March the number of natives employed by this company was 13,311, while at the end of October the supply had been reduced to 8416, equal to a loss of over 36%. The effect is indicated by a diminution in the nominal profit, from £128,193 to £113,306.

Another example of a change of fortune is the Brakpan, which in October of last year recorded a profit of £41,375, and in October of this year only £16,833. The strike, a shortage of labour, and the caving of the hanging wall in some of the principal stopes is reason enough for this distressful contrast. A lower grade of ore in the development workings is another unfavourable factor.

The finding of a patch of banket carrying

visible gold in the Geduld is interesting. The depth was 1500 feet vertical. On examination, even by the unaided eye, it is easy to detect particles of carbon amid the gold. Scientific investigation is promised.

At the meeting of shareholders of the Messina company, Mr. A. M. Grenfell, the chairman, referred with justifiable pride to the fact that their copper mine was now yielding a profit, and that the estimated dividends to be earned from the ore reserve were five times the capitalization of the company. The cost of development has been largely met from the sale of ore. A new concentration plant, with a capacity of 10,000 tons per month, is nearing completion, two reverberatory furnaces are already at work, and railway communication with Pretoria and Cape Town will be available by the end of the year. The shareholders are to be congratulated on having an efficient mine-manager in Mr. Allan Woodburn and a well seasoned metallurgist in Mr. T. D. Nicholls. The paper by Mr. Woodburn on the Messina mine, an abstract of which is given in our *Précis of Technology* this month, is of timely interest.

We note that the third annual mining exhibition under the auspices of the Chemical, Metallurgical and Mining Society of South Africa will be held at Johannesburg during April of next year and will remain open for two weeks.

The decrease in the Consolidated Gold Fields dividend is not surprising. Its Rand holdings are on the down grade and market conditions have been all against this company's usual share speculations. The writing-off of £1,400,000 owing to depreciation on so-called investments indicates how the speculative tide has ebbed during the past year. In 1910 the shares of this financial corporation were quoted at £7; on the declaration of the diminished dividend they fell below £2. The Gold Fields has lost tremendously in character since the days when it served as an outlet for the con-

tinental energies of Cecil Rhodes and Charles Rudd.

RHODESIA.—The output of gold in September was 59,535 ounces, worth £250,430. This is within 20 oz. of the August yield. So far this year the total output is £2,162,478, as against £2,032,678 in the corresponding period of last year. The number of producers increased to 200 in September. Among the more important mines no marked changes are recorded.

The Selukwe Columbia mine is worked out, the final clean-up being due in December. Meanwhile, some new property, covering the Wonderland, Chimborazo, and Danga blocks, is being prospected, with encouraging results.

The latest quarterly report from the Lonely Reef mine gives an estimated reserve of 173,000 tons, averaging 18'15 dwt. per ton. This compares with 184,000 tons, averaging 20'05 dwt. at the end of the previous quarter. The decline in tonnage and grade is due to disappointing development between the 9th and 10th levels. On the 8th level the ore-body is 904 feet long, on the 9th it is 680 ft., and on the 10th it has proved profitable for only 160 ft. as yet. In our issue of June 1912 we criticized the flamboyant statement of the chairman, Mr. C. F. Rowsell, that the mine had increased in richness with depth and that it had done so "quite regularly." That was not a scientific statement, either then or at any time since. We analysed the official figures and proved that the idea of progressive enrichment was illusive, and we suggested that the Lonely Reef at 30 shillings per share might be a reasonable speculation, but not an investment. At that time the shares stood at £3½; now they are 2½.

The cutting of two seams of coal in a bore-hole sunk on the Luano area may prove important to the Tanganyika Concessions, by decreasing the cost of coke delivered to the copper smelter at Katanga.

The departure of Sir Starr Jameson and

Mr. Wilson Fox to Rhodesia in connection with the land settlement and ranching scheme, about to be started by the Chartered Company, is a notable event. While such a development would assist the mining industry, we prefer to regard it from a wider point of view as a realization of political responsibility and an expression of loyalty to the ideas of the great founder of Rhodesia.

WEST AFRICA.—An increase of £6300 is recorded in the value of the gold output for September. The total production for 9 months was £1,237,381, as against £1,072,683 in the corresponding period of last year. Among individual outputs that of the Abbontiakoon continues to increase slowly, the Taquah exhibits a good gain, and the Bibiani a sudden decrease.

The Taquah makes an improved showing despite the troubles with the power-plant, which has been serviceable for about half the year only. Nevertheless, the working cost has been reduced 4s. per ton, to 36s. 6d. Capital expenditure and loan account exhibit encouraging diminutions. The most notable improvement, however, is the greater average stoping-width, which has increased from 69 to 78 inches without appreciable diminution in grade. The lowest, or No. 12, level yields pleasing evidence of continuity, the report giving a width of 81 inches assaying 65s. 6d. per ton.

An interesting feature of the Nigerian Tin Corporation's latest report is the statement that two promising lodes have been found and are being tested. Both lodes are narrow, from 12 to 24 inches, but they are said to be 'going down.' We hope that the Jemaa episode will warn the engineers to be careful in their statements, as, so far, they have been. These discoveries and the finding of additional alluvial deposits will encourage the development of the Ninkada area.

Mr. J. J. Hunter, manager of the Berrida, appears to have been making an active tour

of inspection among the neighbouring properties. His recommendations will, we believe, prove salutary. Among the mines inspected by him are the Juga, Gow, South Bukeru, Minna, and Naraguta Extended. We hear good news concerning the Naraguta, Naraguta Extended, Bisichi, Rayfield, and Kaduna. Except the last, these enterprises, like other Nigerian companies, are over-capitalized and are labouring under a heavy burden. An uncertain supply of water renders operations precarious, the ground is patchy, and reliable estimates are almost impossible.

The sensational rise in Damo shares remains unexplained. At the meeting an unpretentious account of his prospecting work in the Badiffi district was given by the company's engineer, Mr. F. R. McMahon, but it disclosed nothing remarkable. Apparently the "negotiations with a powerful group" led sundry persons to anticipate a rigging of the share-market.

AUSTRALASIA.—Good developments are reported both from the South mine and the South Blocks at Broken Hill. In the British and the Block 10 mines there have been disclosures of ore more interesting than commercial, as yet. They afford indications, however, that are favourable to the prospective value of the western ground. The Sulphide Corporation has struck the lode on the 1300-ft. level, a fact at least as important to the South company.

On October 18 the manager of the North Broken Hill announced the cutting of the lode on the 1400-ft. level. Later boring proves that the ore averages 15% zinc, $17\frac{1}{2}\%$ lead, and 10 oz. silver for a width of 112 feet. This compares with 13'4% zinc, 16% lead, and 7 oz. silver on the level above, and with an average of 13'3% zinc, 15'8% lead, and 7'2 oz. silver actually extracted in the mill during the last 7 months. This drill sample assays about the same as the corresponding section of the lode on the 1250-ft. level, which, at that point,

was above the average of the mine. The width given by the drill-core is greater than the normal, and indicates an enlargement of the orebody.

Some excellent assays have come from the Associated Northern company's mine at Oro Banda—the Victorious. On the 5th level about 180 feet of 3 oz. ore has been proved; this comes in two lengths of 100 and 80 feet, respectively, separated by 80 feet of unprofitable lode. On the 6th level the hanging wall where first intersected showed free gold. Evidently the distribution of rich ore is so erratic as to render any estimate dangerous.

The resignation of Mr. H. C. Bellinger has been received by the board of the Great Cobar. A complete reorganization of that company's affairs is imperative.

The Mount Elliott company is negotiating for the Old Cloncurry Freehold, a property with surface prospects. This explains the support from Paris.

The Great Fitzroy returns indicate that by oil flotation the extraction of copper is 87% and of gold 72%. We understand that the briquetting of the concentrate has proved much cheaper than sintering, but it remains to be shown how the briquettes behave.

At the instance of Mr. Thomas Mills a committee of investigation has been appointed to consider a proposal to sink a shaft to 4000 feet at Charters Towers, Queensland. Mr. Mills has long been honourably connected with local development. The committee includes the warden, Mr. J. G. Linedale, the Government geologist, Mr. W. H. Rands, and the chief Inspector of Mines, Mr. C. F. V. Jackson. A later cablegram states that the decision of the Government is adverse.

The rise in Waihi shares from 37s. on June 1 to about 57s. on November 1 does not appear to us to be justified. The prospects of the company may be "improving," in that some low-grade ore has been found, but the extent of it is quite insufficient to warrant an advance

of £500,000 in the valuation of the mine. Owing to a coal strike in New Zealand, the supply of coal is inadequate for the pumping plant. Hence, on November 4 it was announced that the C pump would be stopped, causing all work on the No. 11 level to cease.

INDIA.—The Jibutil Gold Mines of Anantapur has arrived at the milling stage and the first clean-up will be made at the end of this month. The ore reserve is estimated at 44,000 tons and at several points the prospects are extremely promising. It having been decided to commence development on a large scale, the necessary funds, £25,000, are being raised by re-construction of the company. A year ago a similar amount was raised, by the issue of preference shares, for the purchase of the metallurgical plant. The property was originally developed by the Nundydroog company, which subsequently floated it as a subsidiary in the summer of 1911.

CANADA.—From Dawson we learn that the discovery claims on the Chisana have been bonded by Hamshaw and others for \$410,000. Hundreds are preparing to 'mush' thither with the first frost. Fully 10,000 men are expected to be at Chisana by the spring. The digging is shallow. In the Klondyke valley the big (16½ cu. ft. bucket) dredges designed by J. W. Boyle are working well, averaging 14,000 cubic feet daily.

Reuter contributes a paragraph to the daily press announcing a copious flow of oil from 2000 feet deep in a well bored in a locality 60 miles south of Calgary, but this may be only the precursor of a flamboyant prospectus, so we await further confirmation.

UNITED STATES.—The Camp Bird report shows a marked decline in profit. It was known that the old mine in Colorado was on its last legs, but it was anticipated that the Santa Gertrudis would more than compensate. It has proved otherwise. The total profit for the year is £231,130 as against the £412,000 indicated in the chairman's speech last year.

As against 1912 the profit this year is £150,000 less. This is due, as we stated several months ago, to the disappointing development of the Santa Gertrudis in depth. The estimates of ore always did take a good deal for granted.

The Pato dredge—for the Oroville Dredging company—continues to do well. Recent returns have averaged from 80 to 90 cents per cubic yard, but the capacity of the dredge is low, namely, only 23,000 cu. yd. per week. Mr. W. A. Prichard is on his way from San Francisco to examine the outlying areas be-

the San Dionisio, Edwin Wilson and George Wilson, underground managers, Frederick Drewitt, engineer, and John Gilbert, foreman. We refer to the matter elsewhere. Mr. R. E. Palmer, the chief engineer, has resigned after 12 years of efficient and faithful service.

MEXICO. — Political demoralization has been followed by the disorganization of monetary exchange. The gold dollar has gone up to 2'85 in pesos. Foreign trade is paralysed. Import duties have been raised 50%, causing a drastic decrease in business. The fall in



A PART OF THE RIO TINTO MINE.

longing to the company, with a view to reporting on the best manner of exploiting them.

We refer to the Natomas Consolidated elsewhere. This company is about to be re-organized with a view to raising the necessary additional working capital. For that purpose, it will be registered in England under an amended name.

SPAIN.—Strikes have interfered with operations at Rio Tinto since the early part of September. On November 1 the strikers set fire to the Alicia shaft of the San Dionisio mine, which collapsed, and an effort to save the shaft ended in the death of five Englishmen and two Spaniards. They were overcome by the fumes. The victims include Robert Sach, underground superintendent of

sterling value has led to the melting of silver coins for the purpose of exporting the resulting bullion, and the Mexican Government has had to issue a decree penalizing such tampering with its depreciated currency. It has been reported that Huerta intends to impose a tax of 15% on deposits; the banks are nervous; business houses do not know where they stand. In short, the political chaos has finally resulted in commercial paralysis. Conditions are so bad that they cannot last.

We hear that Mr. André Griffiths has had to meet considerable opposition in his effort to reorganize the work at the Dos Estrellas, at El Oro. The local press has been used by friends of the previous management to undermine his prestige and hamper his reforms. An

effort to cut expenses led to Government intervention, resulting in a satisfactory agreement.

The statements made at the Mexico of El Oro meeting are satisfactory. While the exhaustion of the upper levels is acknowledged, the developments in depth are said to be highly encouraging. The manager reports finding ore on the 9th level at a point 600 feet farther north than was the case on the levels overhead. He has cut what looks to be a continuation of this ore on the 10th and 11th levels. We congratulate Mr. Fergus Allan, the manager, and Mr. André P. Griffiths, the consulting engineer, on these encouraging developments.

Unless work is interrupted the cross-cut at the 2000-ft. level of the Nueva Luz, at Guanajuato, will shortly cut the Veta Madre, only a few metres remaining to be driven. The temperature at the face is 114° F., but by blowing 1800 cu. ft. of air per minute the air is cooled to 101°.

A telegram from the El Tigre states that a cross-cut on the second level has cut a new vein, 150 feet east of the Tigre lode, and that this vein where intersected is 20 inches wide, assaying 295 oz. silver and 6 dw. gold per ton. A cross-cut from the third level has been started, to test the persistence of this orebody.

RUSSIA.—The success of the Tanalyk debenture issue is a compliment to those in control, as well as to the property. In order to provide funds for further equipment and development, the company offered £200,000 6% debentures convertible into shares at the rate of 33 shares per £100 debenture.

Further good drill-cores are reported from the Kyshtim. No. 11 bore cut ore fully up to grade at 741 ft. vertical.

OIL.—A fire has devastated the petroleum district of Moreni, in Rumania. The conflagration was finally extinguished by the use of sacks filled with sand. A well caught alight, through an explosion, and the fire spread to the neighbouring wells, until 25 were involved,

and the whole valley become a sea of flame. Of the wells destroyed, 10 belong to the Romano-Americana, 7 to the Astra-Romano, and 2 to the Colombia company. The production of the Moreni district represents 60% of the entire Rumanian output.

According to New York advices, the Royal Dutch-Shell group is about to acquire the Mays Consolidated oil properties. The price is \$1,050,000 in cash, and the purchase is being made through a subsidiary, the American Gasoline Co. The Mays Consolidated owns 480 acres in the North Midway oilfield, in Kern county, California.

The General Petroleum Company of California is to be turned into an English corporation as a preliminary to the raising of further working capital under the leadership of Messrs. Andrew Weir, Arthur M. Grenfell, and H. C. Hoover.

VARIOUS.—It is proposed to reconstruct the Oroya Leonesa owing to the demoralization of that company's finances caused by the unproductive character of the operations during the past two years. This unhappy result is due to revolutionary disturbances in Nicaragua, rendering it impossible to obtain an adequate supply of labour. The treatment plant has been completed, but it cannot be worked for lack of men. The company's working capital having been exhausted, as well as the temporary loans, it becomes necessary to go into voluntary liquidation. A new issue of shares and debentures will be underwritten by the Lake View & Oroya Exploration company. It is stated that arrangements have been made for the provision of the necessary workmen.

A 7-ft. open-connected dredge has been ordered from Fraser & Chalmers by the Kamunting Tin Dredging company in the Malay States. The design has been prepared by Mr. M. T. Nelmes Bluck, consulting engineer to the dredging company. Delivery is to be made in 7 months.

EDITORIAL

WHY is the president of the Institution elected six months before his induction into office?

UNDER 'Discussion' we publish a letter from Sir Thomas Holland on the question of the Imperial College and London University. His qualifications for expressing opinions on educational affairs are happily associated with keen wit in the expressing of them.

SUNDRY criticisms of the Esperanza management have appeared of late. Many of them have emanated from Mr. J. D. Helm. In this issue he makes his attack, to which a reply is made by Mr. H. A. Titcomb, the company's consulting engineer. Enough has been said.

OUR good friend, Mr. Ralph Stokes, enriches this issue with interesting comment on the future of the Rand, a subject brought into the foreground by Mr. G. A. Troye's article, appearing in our July issue. Such comment is the highest compliment to an author, and we hope that our readers will appreciate the fact. We have no great liking for pontifical utterances that exhaust a subject and squelch further consideration of it. On the contrary, we believe in the shaping of opinion through the interplay of ideas as expressed in writing or speech.

ACCORDING to the latest available data, the area of the City of London is 673 acres or a little over one square mile. The administrative county of London covers 117 square miles, and possesses 4,521,685 inhabitants. Greater London, which includes the City and the Metropolitan Police district, and

is defined as containing every parish the whole of which is within 15 miles from Charing Cross or any portion of which is within 12 miles, has an area of 693 square miles and a population of 7,251,358, as ascertained by the last census. But in addition, many Londoners live outside this radius, at such places as Watford, West-cliff, and Woking.

IN THESE DAYS of cheap hero-worship it is inevitable that real heroism should be overlooked by the readers of a sensational press. We desire to record an incident of the Senghenydd disaster. A few hours after the explosion in this Welsh coal mine, it was known that all those who went underground to rescue or search for the 400 entombed miners would do so at the risk of their lives. However, the committee of seven men who had the rescue work in hand decided to lead a forlorn hope. So desperate were their chances—says *The Times*—that these seven men went to separate parts of the room and wrote farewell letters. Three made their wills. Then they went to work. They succeeded in bringing 18 men to the surface. That is worth more than bushels of Arctic histrionics.

THE CASE of Ashmore v. Nigerian Alluvials brings to the surface an experience not uncommon to mining practitioners. The plaintiff, Mr. G. Percy Ashmore, A.R.S.M., was retained to make an inspection in Nigeria, and, after waiting from June to December, was informed that his report would not be needed, as the company had misfired. The two directors who engaged him thereupon disclaimed financial responsibility. Mr. Ashmore brought suit, and the case was settled after one day's hearing in court. In making engagements it is well for engineers to have a definite agree-

ment with directors as individuals whenever there is reasonable doubt as to the status of the company involved. Men as directors will often do what they would be ashamed to do as gentlemen.

REUTER'S Agency has got into trouble by issuing a circular from its Financial Publicity Department, a branch of Reuter's Telegraph Company, implying that it possesses special facilities for securing the insertion in newspapers of editorial paragraphs concerning companies applying to the public for capital. This was resented by the Newspaper Proprietors' Association, which threatened to refuse all advertisements coming through Reuter's Agency. Whereupon the offending circular was withdrawn. Not many days ago we saw a lengthy paragraph on Malay mining in several newspapers; in some cases, but not all, it was credited to Reuter's; in all cases, however, it was a puff preliminary to the issue of the Ipoh prospectus. It was an advertisement masquerading as news. We are in entire accord with the Newspaper Proprietors, but we venture to suggest that they should address a circular to themselves, warning themselves not to do what they resent Reuter's suggesting that they should do. The newspapers of London insert the reports of company meetings in their reading pages, when, of course, such matter should appear in the advertising pages, because payment is made for the publication. Again, reading notices, puffing or commenting amiably on things advertised, are accepted from advertisers and inserted in the news columns or amid editorial comment, from which they are indistinguishable to the ordinary reader. Even the best newspapers give this sop to advertisers and by doing so not only diminish the trustworthiness of their reading matter but lessen the value of their paper as an advertising medium, for anything that lessens the reader's confidence will diminish his desire to

read, and, by that much, discounts the value of the advertising, which is usually seen in consequence of the readableness of the paper or magazine.

APPROPOS of the Reuter affair, *The Times* has set a good example in refusing to accept news supplied by advertising agencies or advertisements coming through news agencies. Each agency is to be regarded as fulfilling one function only. The next thing is for *The Times* to set a further good example by keeping its advertising pages for advertisements only and its reading pages for matter originating in its own office. If reading notices, that is, puffs supplied by advertisers, and accounts of public meetings, for which space in *The Times* is obtained at specified rates, are relegated to the advertising pages, where they belong, then journalism in London will be freed from a most insidious form of corruption.

PUBLIC SUPPORT is being given to the influential British committee organized to urge upon our Government the importance of an official participation in the Panama Exhibition at San Francisco in 1915. Early in August it was announced by Sir Edward Grey that the Government did not feel justified in making a grant of £250,000 for the purpose of an adequate national representation of exhibits. Since then it has been ascertained that a smaller amount would suffice, and that the interest of British manufacturers was much greater than was supposed. We hope this committee will be successful. It would be a great pity for Britain not to participate cordially in the Exhibition. The time, the place, and the occasion unite in rendering friendly co-operation both desirable and appropriate. The century of peace, the lowering of the tariff wall, and the opening of the great water-way across the Isthmus constitute a triple call to the get-together spirit of the

two peoples whom the Atlantic joins and whom the Panama Canal will unite in further community of endeavour. If commercial reasons are wanted, we can refer to the annual importation of £12,000,000 worth of British goods to the Pacific coast and the certainty that this trade will be increased by the facilities of direct water transport. The reduction in the tariff toll and the friendly adjustment of the Panama tolls are further factors tending to reciprocal good-will. Sentiment and business unite in protesting against official abstention on the part of our Government in an affair of such mutual international importance.

THE JOHANNESBURG correspondent of the *Financial Times* commented recently on the forecast of the Rand's future, by Mr. G. A. Troye, published in our July issue. It is true he failed to refer to this periodical, but that, we are sure, was only an oversight, not a studied discourtesy. He made note of other forecasts, by Messrs. H. C. Hull, Thomas H. Leggett, and Frederick H. Hatch, but as all of these were made before recent events had cast their lengthening shadows, it is not necessary to criticize them. Incidentally he referred to the estimate of a committee of engineers made on the occasion of Mr. Joseph Chamberlain's visit to the Rand, ten years ago, and he mentions a calculation of average working cost based upon "the admittedly drastic principle of deducting dividends from production." On this "drastic principle" the total cost was 23s. 1d. in 1906, and 22s. 11d. last year, as against the nominal, and quite fictitious, figures of 22s. 2d. and 18s. 8d., respectively, given in the reports of the Chamber of Mines. It will be seen that the divergence between the nominal working cost and the real ultimate cost is greater as the mines become older, this being due to the larger proportion of expenditure not immediately connected with the mine and mill, but equally an essential

item in the conduct of operations. The "admittedly drastic principle" is the only one that a sane business man ought to apply, and it is one that the Chamber of Mines should recognize without further delay, if its statistics are not to prove the accuracy of Disraeli's dictum that there are three kinds of untruth: lies, damned lies, and statistics.

RETURNS from the Prestea now give a yield of 33s. per ton as against the recalculated estimate of 44'4s. per ton. It might be well, as we shall see, to avoid meticulous precision and call it 44s. As the former estimated assay-value of the reserve was 41s. 6d., it seems supererogatory to furnish a recalculation that only magnifies the discrepancy between estimation and realization. The annual report says that "the ore extracted during the year has come from the higher grade portions of the ore reserve." Then it was richer than 44s., but the yield during the year averaged only 34s. 6d., and the residue 6s. per ton, therefore, the contents represented 40s. 6d. only. In other words, the statements are contradictory. The recent high residue, higher than 6s., probably as much as 9s. per ton, is due not to an inherent refractoriness in the ore itself but to the graphitic schist that breaks away from the hanging wall, the graphite reprecipitating the gold from the cyanide solutions. In the early days of the mine the residue was poorer because the ore was cleaner. It is futile to break graphitic schist in the mine and then worry the metallurgical department to overcome the difficulty. In the annual report it is stated that "the mill returns are not in accord with the values shown on the assay-plan owing to the unavoidable inclusion of waste rock in stoping operations, and to the treatment of low-grade development rock which had to be hoisted with the ore." As to how unavoidable the inclusion of waste rock may be we are unable to say, but even at this distance from the mine it is obvious that it

would be better to use the low-grade development rock as filling than send it to the mill to degrade the ore from the stopes and increase the difficulty of extraction. At the present time the tonnage crushed per month is 18,000, as against the 35,000 tons promised in days of greater ease and less responsibility. Yet Mr. Edmund Davis, the chairman, ventured to take part in the criticism of Sir George Farrar, at the East Rand Proprietary meeting in 1911. Those who own motor-cars should not sprinkle tin-tacks on the road.

RIO TINTO is in a bad way. The strikes that have crippled the operations of this great mine are bad enough, but the underlying causes are worse. We publish a deeply interesting letter from a correspondent known to us to be well informed and trustworthy. Under Mr. C. W. Fielding's direction and under the local management of his representative, Mr. W. J. Browning, the Rio Tinto has suffered continually in one important respect, namely, the lack of that very 'solidarity' for which the labour agitators make claim. Loyalty and co-operation are qualities of great economic value, and Mr. Fielding has been unable to evoke them. The stay of members of the staff at Rio Tinto is so brief as to be proverbial. Half the profession seems to have been employed there at some time or another. A dictatorial control, a tendency to interference in matters of detail, and even occasional espionage have tended to create an atmosphere of dissatisfaction wholly uncongenial to such good feeling as is necessary to large engineering operations. The discontent has been passed on, it has spread among the Spanish employees, until the entire personnel at Rio Tinto has been infected with the same disloyal spirit. The fact has been known to many for years, but it has been suppressed. Even now the news coming from Huelva is meagre in the extreme, and censored. It always has been so. The shares are largely

owned by estates for which the Rothschilds are trustees, the number of shareholders able to assert themselves is small, and the control of the company's affairs is in the hands of an egoist, always assertive of his authority and always quick to stifle information, whether technical or financial.

A FEW months ago the winning of coal was commenced in Kent at the Snow-down and Tilmanstone pits between Dover and Sandwich, the event marking an epoch in the industries of southeast England. The dreams of Godwin Austen and the geological prophesies of Professor Boyd Dawkins have thus been realized. For the material success of the development, the chief credit is due to Mr. Arthur Burr, who, though he has been blamed for carelessness in connection with his own financial position, has supplied the energy and enthusiasm so indispensable to mining ventures. The main obstacle to earlier success has been the immense flow of water from certain beds of the overlying chalk. It is now decided to amalgamate several companies that were originally formed for the development of individual tracts of mineral land and to work collieries on the consolidated estate by a single company. Mr. Burr retires from active control, for his health is broken. The new board consists of practical men in various lines of business, and a large amount of additional working capital has been promised in London.

THE BRITISH SOUTH AFRICA company has issued proposals for developing the agricultural resources of Rhodesia, by encouraging immigration and settlement on the land. Sir Starr Jameson is to visit the colony and explain the scheme. It will be remembered that the charter of the company expires next year, or at least its terms are then subject to revision as far as they relate to administrative and public mat-

ters. The general feeling in other parts of South Africa and in many circles in this country is that the occasion should be taken to incorporate Southern Rhodesia in the Union. Those interested in Rhodesia assert that the residents would object to such a proposal, but until their views are ascertained by referendum we prefer to bear in mind the experience in connection with the inclusion of Natal. Perhaps the promulgation of the new scheme is intended to check the policy of absorption. At any rate it may be taken that the directors are now inclined to admit that the mineral resources of the territory are not sufficient in themselves to serve as a foundation for a thriving and prosperous community. Even now, however, their agricultural deals are on the wholesale scale characteristic of the original parcelling of the country, for the Liebig and the American ranchman's contracts are not such as would bring a permanent and contented population. We hope the new scheme will be more for the benefit of what is called in this country the yeoman farmer.

M.I.M.M. or M.I.C.E.

In the days before our Institution was organized it was natural for mining engineers to desire membership in the Institution of Civil Engineers, and even now it is conceivable that members of the Institution of Mining and Metallurgy may like to maintain a friendly intimacy with the older society; but if our Institution is to be recognized as the representative organization of mining engineers in London, and if membership is to be deemed a sufficient *prima facie* evidence of fitness for the work of mining engineering, then it becomes undesirable for an M.I.M.M. to pose as an M.I.C.E. We note that the president elect, Dr. F. H. Hatch, is described in the public press as M.I.C.E., as if membership in that institution involved any sort of qualification for the presidency of our Institution. Last year another president, Mr. Edward Hooper, when presid-

ing as chairman at a mining company's annual meeting, was described as an M.I.C.E., and we demurred at the time to the idea that a member of the civil engineering society had necessarily any special aptitude for the business of mining as compared with a properly accredited member—especially the president—of the Institution of Mining and Metallurgy. In these matters, we suggest, the members of the Institution, and more particularly the members of its Council, ought to be consistent. Time was when, in for lack of a mining engineering society, it was natural for mining practitioners to join the Institution of Civil Engineers, which society, in a broad way, undertook to gather under its wings the whole of the engineering profession. For that early hospitality we are not ungrateful. It was a *poste restante* in the advance of mining engineering as a distinct profession. But a man does not reside at a hotel or even at a friend's house when he has a home of his own. We ought to maintain cordial relations with the other branches of engineering, but it is high time to maintain—even to assert, it may be, on occasion—the identity of mining engineering. The removal of the offices of the Institution into its freehold quarters will be an outward and visible sign of the consummation of that purpose.

Consulting Engineers as Directors.

At the Siberian Proprietary meeting the question was asked whether it was desirable for consulting engineers to serve concurrently on the board of the mining company to which they are attached professionally. The point was raised in connection with the position of the chairman, Mr. Edward Hooper, whose firm acts as consulting engineer to the Siberian Proprietary Mines and to its subsidiary companies. In reply to criticism, Mr. Hooper refused to allow that any impropriety or even inadvisability existed in a consulting engineer serving as director. We endorse this view of

the matter, which, moreover, is worthy of further consideration. Do the duties of a director conflict with those of a consulting engineer? What are those duties? Until we answer the second, it is useless to reply to the first, query. The function of the director is to act as trustee for *all* the shareholders; the function of the consulting engineer is to act as technical advisor to the director. Anything that conflicts with the proper performance of the duties of a director is likely to conflict with those to be performed by the consulting engineer; on the other hand, it is quite possible for the one to perform the duties of the other, if qualified to do so by previous experience. One thing there is that impairs the efficiency of a trustee, and that is speculation in the shares of his trust: and by the same token the one thing that most quickly detracts from the value of the technical advice of a consulting engineer is speculation on his part in the shares of the company whose technical operations he directs. These should be truisms, but they are not yet regarded as such in the city of London. To some they will seem irritating heresies and to others they will sound like counsels of perfection quite inapplicable to a workaday world. But those who take such views will find that the logic of events is an argument difficult to refute. The day will come when such truisms will be deemed irrefutable. For the present we are content to agree that, under given conditions, it is proper for the consulting engineer to be a director; indeed, we believe that it is highly desirable that the consulting engineer should have a seat on the board, not to be called to, or dismissed from, the council-table at the whim or will of the chairman or some other director, but to attend all the meetings of the board as an integral part of the executive of a joint-stock company. To be efficient, however, he should not be a large shareholder; indeed, he ought to be a director with the bare share qualification, if any. Most certainly he should at no

time speculate, that is, buy and sell shares at short intervals, nor participate in any way in the promotion of the company or in subsequent brokerage dealings. Until some of these fundamental principles are honoured by observance the mining profession will be regarded as an adventurous and nomadic occupation connected with queer doings on the Stock Exchange.

The Mexican Crisis.

During the past month the condition of anarchy in Mexico has been accentuated by a succession of events, all trending toward the inevitable: intervention by the United States. On October 10 a protest was made by 110 deputies against the mysterious disappearance, or assassination, of sundry members of Congress. To this President Huerta replied by demanding a withdrawal of the protest; when refused, he filled the Parliament House with troops and arrested the recalcitrant deputies. Both branches of the Mexican Congress were ordered to be suspended, Huerta becoming dictator *de facto*. October 26 was fixed as the date of a general election. On October 14 the United States government notified him that, in view of his *coup d'état*, the election would not be recognized as constitutional. On the date fixed the election took place, without disturbance, but the fear of Huerta and the general disorder combined to keep the people from voting. The number of votes registered was so small as to render the result nugatory. Three candidates were prominent: Huerta, Gamboa, and Felix Diaz. The last fled for protection to an American gunboat at Vera Cruz. Meanwhile, in the North the insurgents under Carranza are gaining ground; the capture of Torreon, an important strategic point, has been followed by an attack on Monterrey and Chihuahua. General Carranza, formerly governor of Coahuila, is well established in Sonora, and his followers, under the name of Constitutionalists, pose as the real patriots.

An interview with Carranza published in *The Times* of October 27 illustrates, however, that he also has ideas no more civilized than those of Huerta, for he calmly informed his questioner that any members of the Federal party, or anyone known to be in sympathy with them, would be "executed" when captured. The Mexican position is that of a cat-and-dog fight, a contest between military adventurers, a seething mass of barbaric anarchy, in which the intelligent and educated people of the country are merely supine, pusillanimous, and powerless spectators. It is obvious that conditions have come to such a pass that interference is necessary. The property and lives of foreigners are in continual danger, not to mention the safety of the native population. It may be said that it is none of our business how the Mexicans fight and misgovern themselves, but the day is past for such a detached view of international relations. If your neighbour burns his stable, beats his wife, and shoots over your wall, you ask the other neighbours to join you in suppressing him, or, if you live in a civilized community, you go to the police. To anyone asking why the United States is so forward in its interference with Mexican affairs, we say: Look at the map. If the American President takes the matter in hand, and requests European support, it is not surprising. By the obligations of neighbourhood and by the heritage of the Munroe doctrine, the United States is under compulsion to act as policeman in keeping Mexico in order, lest our nationals and those of other European countries suffer from murder, pillage, and confiscation. We have found no reason, as yet, to doubt the sagacity of President Wilson, but if he removes the embargo on arms and ammunition going across the border to Carranza, he will run the risk of having those arms used later against American troops, for it is quite on the cards that the Mexican factions may unite against the common enemy. If they do not, the country will

be victimized by successive 'revolutions' until intervention will become imperative. The American government is already committed to the expulsion of Huerta from his dictatorship. This renders military intervention inevitable, sooner or later.

James Bryce has said that "South America begins at the Rio Grande del Norte." We venture to amend that epigram by saying that South America begins at the Panama Canal. By the violent seizure of a strip of country on either side of the Canal, in 1904, the United States threw its frontier forward 2400 miles south of the Rio Grande, and came under the impulse of a new destiny, namely, to extend its flag southward to the far-flung frontier of the Canal zone. Whether the intervening territory is conquered, annexed, or Egyptianized is a matter of detail. We hold it certain that the sovereignty or suzerainty of the United States is destined to extend to the Canal. Whether it comes in consequence of the present Mexican imbroglio or otherwise, it will come to pass.

Natomas.

A new departure was made at the Natomas meeting when the financial statement was preceded by a cinematograph or 'moving pictures' illustrating the company's property and operations in California. The idea is a good one. Shareholders and bondholders in enterprises abroad will probably enjoy an occasional illustrated lecture on subjects touching their pocket. In this particular case the performance was marred by defective focussing, and the accompanying lecture was not as effective as it might have been, partly owing to the noise made by the machine itself, in a subterranean chamber of Salisbury House. However, the photographs were pretty and in that respect offered a contrast to the unlovely picture of the company's finances as portrayed by Mr. Frank Griffin. In brief, he had to confess to a grave miscalculation. A shortage

of one million dollars and a further requirement of two millions made it necessary to raise \$3,000,000 more in order to bring to fruition an enterprise involving \$15,000,000 in bonds. In the course of his explanation he had to refer to sundry reclamation bonds, the mention of which provoked a long argument across the table, Mr. Harry Mosenthal and other bondholders confessing their inability to understand why the existence of such a prior lien, even if in small amount, had not been made clear to them at an earlier date. At this stage of the proceedings the chairman, Lord Ribblesdale, evidently was badly bunkered, but a good recovery shot from Mr. F. W. Baker returned the ball to the fairway. However, other hazards remain to be negotiated. We are informed from San Francisco that some of these reclamation bonds have been hypothecated to local banks. The difficulty may not prove serious if further funds are forthcoming as required. It was announced at the meeting that the American bondholders, who hold two-thirds of the \$15,000,000 issued, have accepted the situation and agree to set aside the terms of the trust deed to the extent of postponing interest for five years and endorsing a scheme, yet to be elaborated, for raising the necessary working capital. Some of those present at the meeting complained of the lack of information given to them as shareholders and bondholders; and in this they have our entire sympathy. It is a great pity that clever men such as those controlling the Oroville and Natomas enterprises should alienate public confidence in London by withholding information to which the proprietors, namely, the shareholders, are plainly entitled. In this case it is the mortgagees or bondholders, not the proprietors or shareholders, that have reason to complain, for the shares of the Natomas Consolidated represent merely the water sprinkled on the senior security. Despite irritation at the withholding of information,

most of those present were inclined to give Mr. Griffin and his coadjutors in California a second chance and to support them in any reasonable new proposals. It will be remembered that among the capitalists heavily interested in Natomas are Messrs. E. J. de Sabla, Leon Schloss, E. R. Lilienthal, and W. P. Hammon. Until July the question of raising further money, necessitated by an expansion of operations beyond the original plan, presented no terrors to these gentlemen. But at the very moment when arrangements were about to be completed for this purpose, a local financial crisis, due to the failure of F. M. (known as 'Borax') Smith, upset the scheme. That is one reason why the acknowledgment of a discrepancy came with so little warning to the British bondholders. It does not seem to us that they need face ultimate loss. If fresh capital is not raised, some vexatious proceedings may be necessary, but the bondholders will not lose control, nor will the business suffer irreparably. Meanwhile it is up to the gentlemen at San Francisco, who, partly by an error of judgment and partly through lack of attention to the affairs of the company, have brought it to this pass, to put their shoulders to the wheel and raise the additional capital. The yield estimated from dredging was \$5,139,092 in three years; the actual return has been \$3,033,235. The dredging plant cost \$800,000 more than the estimate, so that the total difference is about \$2,800,000. Additional land purchases absorbed \$1,000,000, the total discrepancy being \$4,600,000. But, owing to economies in sundry departments, the final difference is only \$3,000,000 in 3 years, as against the bond issue of \$15,000,000. The enterprise is, we believe, a sound one; the present position is due to biting off more than could be assimilated comfortably. The one estimate that looks truly ridiculous now is the consulting engineer's estimate of the expected yield of gold per cubic yard of gravel; he gave it to four

decimals, or one ten-thousandth of a cent. Compare this with a discrepancy of \$2,800,000 in 3 years. Here we have an excellent example of the futility and absurdity of meticulous precision. It stultifies engineering.

Tomboy.

Just about the time when we begin to think that mining is a queer game we get a copy of the Tomboy report and an account of the annual meeting of that company. The Tomboy Gold Mines is an enterprise the history of which makes a cheerful page in the mining record. It has had strange vicissitudes and has afforded repeated chances for financial legerdemain. The vicissitudes have been smoothed into pleasant episodes, and the chances for funny business have become opportunities for honourable dealing. It was in 1897 that the control of the original Tomboy was acquired, after being examined by a galaxy of talent. In 1899 the undertaking was registered in England, and immediately thereafter the mine gave signs of impoverishment in depth. Operations on the Tomboy ceased in 1903. The orebody faded away at about 600 feet from surface. Meanwhile an option had been obtained on an adjacent property, the Argentine, and in 1901 this mine was purchased for the Tomboy company. No new company was formed, with incidental loot to the promoters; on the contrary, the manager, to whose initiative the business was due, and the directors, who supported him, united in remembering their duty to the Tomboy shareholders, who obtained the full benefit of the transaction. Once more on its feet, the company did well. A profit of \$3,412,000 was won from the Argentine, on a purchase price of \$65,000, before it, in turn, became exhausted at 600 feet in depth. Again the directors, real trustees for the shareholders, looked around them for a means of rejuvenating the enterprise, and again they were successful in acquiring a good mine. This was in 1911,

when the Revenue property, in the same locality as the other two mines, was purchased for \$400,000. This deal necessitated a temporary reduction of dividends, but now all debts have been cleared and a return to the former rate of dividends has been made. A tramway has been built out of revenue, and one third of its cost has been written off. As it entailed an expenditure of £8000, and is making a saving of £900 per month, the capital involved will be repaid within 10 months of its erection. We note also that investigations into the milling process have been made by Messrs. Gelasio Caetani and W. Kemmis Betty. The result has been to improve the amalgamation and indicate a method of re-treating the tailing accumulated below the mill. The Revenue, or Montana, property is more than justifying its purchase. During the past year it has yielded a profit of £55,000, as against the original cost of £80,000. The ore in reserve represents over £100,000. No fallacious hopes of enrichment, or even persistence in depth, are entertained. Mr. R. T. Bayliss and his associates of the Exploration Company are too old hands to be lured by such a will o' the wisp; hence the shareholders are saved from the geological bubbles blown by some of the people operating in Rhodesia. The Tomboy is a credit to all concerned. It is an example of legitimate mining properly rewarded.

Globe & Phoenix.

The recent meeting of shareholders in the Globe & Phoenix Gold Mining Company illustrated most of the weaknesses inherent in the operation of mines by joint-stock finance. The chairman, who presided, is Earl Russell, a noble barrister innocent of mining technology, but an excellent presiding officer. On either side of him were more lawyers, but nobody at all versed in mining affairs, except in so far as they may have obtained experience at the expense of the shareholders. The meeting

was called to settle a controversy that has persisted for six months and brought the company into public ridicule. Ever since April a guerilla warfare has been waged by sundry groups of Scottish shareholders over the division of the spoils of office, namely, the directors' fees. The final outcome is the passing of a resolution, whereby each director receives £100 per annum, with 5% of the dividends distributed, provided that such extra remuneration shall not exceed £300 per annum. Thus 9 gentlemen are engaged for a maximum emolument of £400 per annum to administer the affairs of a company having property appraised at £1,000,000. The chairman was offered an extra £100, but, on his threat to resign, the amount was raised to £300, making his salary £700 per annum. Apart from the absurdity of having 9 amateurs to manage a mine, it is also a blunder to make their salary contingent upon results, as if those results depended upon them.

Another subject before the meeting was the recent visit of inspection to the mine, in Rhodesia, made by a special committee of three, of whom one was supposed to know something about gold mining because he owned property in coal mines. This particular gentleman, Mr. Archibald Bowman, sold all his shares before his return, and was thereupon asked to resign as a director. At the meeting this incident was fully ventilated, and it was stated that the gentleman in question threatened to sue for the balance due to him, namely, £250, or one half of his fee for going to Rhodesia. The board refused to meet this obligation because Mr. Bowman's visit "did not result in that advantage to the shareholders which was contemplated." What was contemplated? In any case one wrong cannot be corrected by another; the board collectively appears unable to appreciate the meaning of a contract. Mr. Bowman may seem to the directors to have acted outrageously, but we think he ought to get his £250. His inspection of the mine did

not become less valuable when he ceased to be a shareholder; on the contrary, it was more likely to be unprejudiced. Meanwhile the dominating personality of the three mine inspectors is Mr. H. H. Haldinstein, K.C., who, at the meeting, read his report as presented to the directors on his return from Rhodesia. As we listened to the views and suggestions of this King's Counsel on the administration of a gold mine, we found it unconvincing. An air of unreality enveloped all his findings. His emphasis on the efficiency of the staff and the excellence of the machinery naturally would interest his friends, but it seemed to us a good deal like the ointment that went down Aaron's beard, even to the skirts of his garment, and did nothing else. "In my opinion," he said, the new vertical shaft was necessary. Of course, he echoed merely the opinion of others. He should say who they were. We believe that Mr. Francis Drake was one of them; and his opinion we should value highly. Mr. Haldinstein's own opinion on such a technical subject was worth as much as a miner's opinion on a complex lawsuit. On the whole, while we congratulate the shareholders on a settlement of the wretched fuss about directors' fees, we cannot felicitate them on the choice of administrators. They are like a ship's company on board a vessel navigated by tailors.

Falcon.

We are glad to publish the replies of Messrs. J. C. Pickering and A. H. Ackermann in defence of their examination of the Falcon mine. The pages of this magazine are never put to better use than in helping engineers to set themselves right with the profession and with the public. It is proper to state that an official reply has been made to these letters, but no copy of it was sent to us. However, that does not matter, as it asserts that "the directors [of the Falcon company] have neither the desire nor the intention of entering into

a newspaper controversy." This is wise. They have had a lot to say, and when much of it is proved misleading, they become discreetly silent. The plain story is that Messrs. Pickering and Ackermann made a short visit to the Falcon mine not with a view to checking the official estimates of ore in reserve, but in order to advise their own company in regard to one of those inter-company deals that tend so much to confuse the Rhodesian market. They took sufficient samples for their purpose and had them assayed locally, while sending duplicates for verification by an assayer in London. The results obtained by the Bulawayo assayer became known to Mr. J. G. Macdonald, the manager of the Falcon, who anticipated criticism by telegraphing an attack on the work done by Messrs. Pickering and Ackermann, thereby defending the original estimate. Meanwhile, the duplicate samples had been assayed in London, proving the Bulawayo assayer to be incorrect both in his copper and gold results. We have no reason to suppose that the sampling itself was hastily or otherwise badly performed. Rejecting the Bulawayo assays on the Pickering and Ackermann samples, we find that the London assays on the same samples tally with the independent sampling performed by two other engineers—Messrs. Walter Currie and J. Black—at the instance of the company after the controversy started, and that both their results and those of Messrs. Pickering and Ackermann exhibit a discrepancy with the official assay-plan. Here we come to the most unpleasant feature of the episode: the official circular of July 16 suggested that the independent sampling verified the official assay-plan and flouted Messrs. Pickering and Ackermann. This was misleading. In the comparison different values were assigned both for the copper and the gold. If the same values are used it becomes clear that the two latest samplings agree in discounting the assay-plan by nearly 20%. It

remains to apportion the blame for the premature divulging of the Bulawayo assay-results. Apparently Mr. Macdonald could do so, if asked. This leakage gave ground for resentment on the part of the Falcon officials, while at the same time it afforded them a *prima facie* case against the two engineers in question. That case, on further inquiry, has broken down, leaving the Falcon officials in a hole from which they cannot extricate themselves.

University Agglomeration.

At the last School of Mines annual dinner, a reference was made by the chairman, Mr. Frank Merricks, to the report of the Royal Commission on University Education in London, and a vigorous protest was made on that occasion against the absorption of the Imperial College of Science and Technology by London University, largely because it was interpreted as a further pocketing of the Royal School of Mines amid a grandiose agglomeration of a kind calculated to smother its identity and cripple its usefulness. Before it is too late we desire to express the views of the old students of the Royal School of Mines against the step proposed. In doing so we have authorization from the executive committee of the Royal School of Mines Association. To put it briefly, this further change of status will be one more of a long series of departmental steps that have successively driven the School of Mines from pillar to post, gradually smothering its vitality in an uncongenial environment. We need not retail the weary story. It suffices to refer to the remonstrances made by two great teachers of technology: John Percy in 1880 and Adam Sedgwick in 1910. It is true, the objections of Percy were mainly sentimental, or rather those of sentiment for the place where he had worked so happily, but he also hit upon a truth, often verified during the ensuing years, when he insisted that the removal of the School from Jermyn Street to South Kensington would "destroy the indi-

validity of the School of Mines by mingling its purely technical instruction with what is called general instruction in science." The School of Mines is a post-graduate college, not a kindergarten. Exactly 30 years later Sedgwick, who both at Cambridge and at South Kensington achieved an enviable reputation as professor of zoology, raised his voice against the amalgamation of the Imperial College with the University of London. He died last year, but his words are more enduring than marble. As Percy had foreseen the mistake of mixing the training for a special profession with instruction in general science, so Sedgwick predicted the error of mixing technical training with general culture. The charter of the Imperial College states that it is planned "to give the highest specialized instruction and to provide the fullest equipment for the advanced training and research on various branches of science, especially in relation to industry." Only a few days ago Sir Sidney Lee, the occupant of a new chair of English Literature in London University, stated that "the highest ideal of a modern university is to maintain catholicity in the range of its curriculum." We do not decry this noble ideal when we insist that it involves a purpose radically different from that of preparing young men for a special vocation involving more particularly the commercial application of science to the arts of mining and metallurgy. The academic teachings of a university are intended to produce a "well-balanced rounded-off citizen;" the technical training is intended to produce a captain of industry. We may forbear to insist on the immaturity of London University, at its lack of traditions, at the newness of its pose as an institution for teaching as distinguished from an examination centre, but we do insist that it does not provide, nor will provide in any visible future, for the atmosphere congenial to the production of a specialist in technology. Reference may be made to the fact that many of the American

mining colleges are annexed to, or form an integral part of, universities. This is true, and the fact is found on inquiry to furnish further argument against any attempt to imitate the arrangement. In America education is regarded as a preparation for earning a living; there is an identity of purpose between the component parts of the American universities. The United States lacks "the dreaming head and the subjugated feet" of Europe. Our friends across the Atlantic have no "homes of lost causes," nor do their universities "whisper the last enchantments of the Middle Ages." The American university is frankly utilitarian, and it is grandly useful. The technical college or the school of mines is a younger brother, not a despised cousin from the country. They mix happily; they are annexed successfully. But generations must pass in Britain before the man training for the church or diplomacy, or preparing for the services, will cease to be regarded as the superior of the man who is trying to fit himself for the technical work of a mine or a smelter. The old fallacy is not easily killed. It might have been done if Rhodes had endowed Oriel as the School of Mines of Oxford, but it cannot be done by any such scheme as that recommended by the latest Royal Commission on University Education. Incidentally, we may mention that the two famous Mining Schools of Germany are distinct from the universities. After the buffetings of an unkind fate, the Royal School of Mines has found an anchorage at South Kensington, and is now moored to the Imperial College. It has only just begun to feel safe in its new harbour when another change is proposed. Our old School—for it is old and rich in honourable tradition compared to the others—has methods and purposes in common with the College of Technology. It has been endowed recently with the idea that this relationship will be maintained, and it has everything to lose by being thrown into a new agglomeration.

ROYAL SCHOOL OF MINES

Annual dinner.—It has been decided by the executive committee that the first annual dinner of the Association shall take place on March 17 next. The date is easily remembered as being the birthday of Ireland's patron saint. This will take the place of the customary Old Students' dinner. By that time most of the old students will have joined the Association. The chair will be taken, of course, by the President of the Association, namely, Professor William Gowland, A.R.S.M., F.R.S.

Addresses.—The Hon. Secretary of the R.S.M. Association is anxious to receive the names and addresses of old students, and urges members of the Association to send a list of their comrades at the R.S.M., together with their addresses. As mining engineers and metallurgists are nomadic, it is impossible to rely upon any of the old registers. Until the new card-index of addresses is fairly complete, it seems inadvisable to issue any circular. The committee relies upon each R.S.M. man to join the Association as soon as he hears of it, and expects him to mention the matter to the other R.S.M. men of his acquaintance. In this way a large membership will be created on a basis of good-will rather than formal solicitation.

The Union.—The committee of the R.S.M. Union has decided to accept as life members all the old students of the R.S.M. that join the Association, without any extra subscription. We are informed that the present students endorse this action cordially. The courtesy will be accepted in the spirit with which it is offered, and the result ought to be to increase further the interest of the old students not only in the School itself but in the personnel of the present students. R.S.M. men from abroad are urged to visit South Kensington, see the new buildings, visit the Union club

building, and stay there for luncheon or tea, making acquaintance with the present students when opportunity offers. Messrs. F. W. Harbord and Kenneth Gow have been chosen to represent the R.S.M. Association on the management committee of the Union.

Professors.—The professor designate of metallurgy, Mr. H. C. H. Carpenter, has been given facilities, including financial aid, to make a tour of observation for technological purposes. This new departure meets with the cordial support of the R.S.M. Association, which, through its executive committee, has informed Professor Carpenter that if the official grant should prove inadequate, it will contribute a further sum for the purpose. This, the first use of Association money, will, it is believed, receive the hearty approval of members. It is a practical expression of the Association's interest in the continued efficiency of the School.

Headquarters.—A notable addition of new members for the Association comes from the Indian gold mines. In this case, as at Calcutta, a suggestion has been made that a room or address in London should be rendered available for visiting members, to meet other foreign members and the committee of the Association. The idea is a good one, but the renting of a room would entail an expense not warranted by the Association's financial resources. Meanwhile, the Mining & Metallurgical Club and the reading-room of the Institution are available for social purposes. Any member of the Association can be promised a visitor's card to the Club. Of course, the Hon. Secretary will not only be pleased if R.S.M. men from abroad will call on him, but he will feel hurt if they fail to do so. His address is T. A. Rickard, Salisbury House, London Wall, E.C.

PERSONAL

AUDLEY H. ACKERMANN sailed for South Africa on October 25.

J. A. AGNEW has returned from Peru.

M. W. ATWATER is investigating flotation processes on behalf of the Ohio Copper Company, at Lark, Utah.

E. G. BANKS has been appointed superintendent of the Waihi mine.

R. V. BARTON has resigned as manager of the Broken Hill Junction mine.

J. MACKINTOSH BELL has returned from Canada.

F. K. BORROW sailed for Colombia on November 5.

B. A. BOSQUI is in charge of the new cyanide plant erected by the Commonwealth Mining Co. at Pearce, Arizona.

W. D. BROWN has been appointed metallurgist to the South American Copper Syndicate, and sailed for Venezuela on November 6.

H. C. CALLAHAN is on his way back to San Francisco.

GEORGE P. CHAPLIN has gone to Burma.

JOHN COOPER has been appointed assistant to the general manager, André P. Griffiths, of the Dos Estrellas mine, in Mexico.

W. L. CUMINGS has returned to New York from Chile and Brazil.

ALTON L. DICKERMAN is at Houghton, in the Lake Superior copper region.

ARTHUR DICKINSON was married to Miss Irene Ker on September 20, at Guildford.

J. V. ELSDEN has been appointed joint editor of the *Colliery Guardian*.

W. H. EPLETT is returning from India to Cornwall.

JOSEPH F. B. ERDLETS is now resident in London, his address being with the Russian Mining Corporation.

ROWLAND FEILDING has been elected a director of the Socorro Gold & Silver Mine.

OSWALD FERNIE has left for Potosi, Bolivia.

ALEXANDER FYFE, formerly at Waihi, has returned recently from Mexico.

JOHN GREENWAY, manager of the Calumet & Arizona, is making a European tour.

NOEL G. HACKNEY has opened an office at 118, London Wall, E.C.

HARRY HANNAY has left for Nigeria.

A. L. HAY, lately at the Hainault, has been appointed manager of the Bullfinch Proprietary.

W. A. HEYWOOD sailed on October 18 for Venezuela. He will be absent for four months.

WOLDEMAR HOMMEL has received an appointment on the professorial staff at the Clausthal Bergakademie.

CHARLES JANIN is expected from Italy.

E. H. LIVEING is starting for Western Australia.

F. M. LUSH sailed for Northern Nigeria on October 22.

WALTER MACGRATH has returned from Western Siberia.

MALCOLM MACLAREN is examining the Great Fitzroy mine in Queensland.

DONALD MCHARDY has been appointed to succeed his father, recently deceased, as manager of the Premier diamond mine.

DEANE P. MITCHELL has returned from a long visit in Russia.

T. D. NICHOLLS, formerly with the Cape Copper Co., is metallurgist at the Messina copper mine, in the Transvaal.

R. E. PALMER has resigned as chief engineer at Rio Tinto.

S. G. PEARSON has gone to Canada.

W. PELLEW-HARVEY has returned from Great Cobar.

A. GORDON PLEWS, resident manager for the Peruvian Gold Trust, arrived from Peru on October 10.

W. A. PRICHARD has gone to Pato, in Colombia.

G. A. RICHARD sailed for Brisbane on November 7.

THOMAS RICHARDS has gone to Brazil to inspect mines on behalf of John Taylor & Sons.

LOUIS D. RICKETTS passed through London on his way to the Riviera.

J. B. RISQUE has been appointed manager for the Tennessee Copper company.

LEO VON ROSENBERG, of New York, is now in Sierra county, California.

HOWARD D. SMITH is here from San Francisco.

G. E. STEPHENSON has returned from the Argentine.

J. W. TEALE, of Bainbridge, Seymour & Co., is in Burma.

R. GRILLS THOMAS left for Northern Nigeria on October 15.

GEORGE E. TILLY, on his return from Colombia, is residing at St. Leonards-on-Sea.

W. H. TREWARTHA-JAMES, of James Bros., is making a special investigation for the Carn Brea & Tincroft Mines in Cornwall.

C. F. TROUSDELL is on leave from Bisichi, Nigeria.

J. B. TYRRELL is here from Toronto.

H. S. UNDERWOOD has gone to Broomassie, West Africa.

E. J. VALLENTINE is returning to the Malay States on November 20.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres.

HUELVA.

Rio Tinto.—Following upon a large number of small strikes during the past few months, the whole of the 14,000 men employed by the Rio Tinto company have been on strike since October 16, the ostensible reason at first given being 'solidarity' with the men of the Huelva workshops, who came out in consequence of the discharge of one man for a breach of rules. The strike has become most bitter, the station-masters on the railway, the pump-men underground, and even some of the female servants of the officials having been forced out. Mail trains are run on the company's railway by military engineers, and two companies of infantry in addition to many hundreds of civil guards are maintaining order and protecting the company's property. The men, of course, have presented a petition asking for an 8-hour day (although the majority of them at present work for that or a smaller number of hours), a minimum wage of 4 pesetas per day (the regular minimum wage in the district being 2½ pesetas), and a variety of other concessions. The petition, however, is only a pretext; the real issue is that of domination.

The Rio Tinto employees as a whole, and almost without exception, earn higher wages and do less work than do those employed on similar kinds of work at any of the smaller mines in the Province of Huelva, or in any other part of Spain. They live cheaper, on account of the large co-operative stores organized and managed or supported by the company, which sell at retail prices from 15 to 50% below those current in even the large towns in the south of Spain, and have almost squeezed the small retail shopkeepers out of existence. They have therefore no real or material grievance. The leaders are all professional agitators from Bilbao, Barcelona, and Madrid; none of whom have lived in the district as much as a twelvemonth, and the whole agitation has been not merely fostered or fomented but actually organized and created by these outside influences, the objects aimed at being two in number: The first is the political conquest of the district for the Radical-Socialist-Syndicalist-Anarchist group of factions, rather than parties. These shade into each other in a remarkable way, and

however much they may, and do, mistrust and denounce one another, can be confidently relied upon to act in unison against all the constituted authorities of whatever description, and against the two great political parties, which, as in England, alternately hold office, the parallel holding good as regards the close touch between the left wing of the so-called Liberal party and the popular self-constituted leaders of what in England is the Labour party, and in Spain may be termed the right wing of the Radical-Socialist groups, the left wing of which is frankly Anarchist. The second object of the agitation to organize the men into a union is to get control of the funds represented by their subscriptions, for in Spain, Labour Unions do not publish balance sheets, and the funds are disposed of at will by the Labour leaders, many of whom have become during the past few years suddenly and inexplicably wealthy. In one notorious case a leading advanced Socialist, who seven years ago had scarcely a penny to his name, now owns fine houses in Madrid and elsewhere, and sports servants in livery, several automobiles, and so forth.

Cause of trouble.—The orations of the professional agitators, however, might perhaps have fallen on deaf ears, and their efforts to stir up trouble among men who had no serious material grievance as regards hours of labour, remuneration, and conditions of employment, might have failed—at any rate the strike would have been less complete and far less bitter—but for the existence of two grievances, hardly at all of a material character but purely sentimental, yet none the less real to a people who, like the Irish, are ruled by ideals and swayed by emotions.

The tradition of the staff at Rio Tinto as a whole, and apart from certain notable exceptions, is to consider themselves as a ruling caste, standing socially, intellectually, and in every other respect, upon a totally different plane from the inhabitants of the country in which they live, whom they make no attempt to understand, and with whom they hold so far as is possible no dealings of any description beyond the barest official relations. No Spaniards are employed in any but comparatively subordinate positions, and a number of the subaltern members of the English staff

treat the Spanish staff with unconcealed disdain, while their contempt for the Spanish workman is, like their ignorance of his real character, boundless, and is constantly expressed in the hearing of employees who, having been brought up in the place, speak a little English, and understand almost all that is said. The Spanish employees are made to feel every day of the week that they belong to an inferior race, that, although the latest importation from England who walks to his work (being unprovided with a horse) in riding breeches and gaiters, swinging a hunting crop, may be (and generally is) careless of the company's interest and careful only of his own pleasure, keenness at work being looked upon as bad form and prompted by a desire to score at the expense of others; although he may be (and often is) a round peg in a square hole, and ignorant of most of the things that in the company's interest he ought to know, although he may be (and occasionally is) a hopeless incapable, or even a drunkard, he nevertheless expects to be treated as a commissioned officer, whereas the best of *them*, whatever their ability, can never hope to be anything but a 'non-com.' The rank and file, the ordinary workmen, are looked upon as if they were Chinamen, Kaffirs, or a sort of white niggers, never to be addressed in any way but through a foreman, never to be treated with any consideration, or upon any other footing than that of racial inferiority. Needless to say that such treatment, even when meted out only by a small minority, and by no means by those highest in authority, or even by a majority of the staff, is deeply resented. Spain is neither India nor West Africa, and a general discontent with the lack of common consideration and of the most elementary courtesy, shown by a majority of the English staff to the Spanish employees, has been one of the most potent factors in the success of the organized campaign that has led up to the present general strike.

The other grievance, which is also chiefly sentimental, though its material side is not entirely negligible, is the enormous extent to which it is said that 'palm-oil' flourishes at Rio Tinto among foremen, contractors, &c., and even it is whispered among some of the subordinate members of the English staff. Many of the foremen are said to 'stand in' systematically with the contractors, and 'back-sheesh' is said to be ordinarily bestowed, and in some cases barefacedly demanded for promotion from labourer to miner, on the occasion of an increase in wages, of appointment

as a guard, &c., &c. Whether or not one-quarter or even one-tenth of the current gossip is true, matters little. There can be no big smoke without at least a small fire, and the importance of the gossip, as regards its results, depends not upon how much or how little of it is true, but upon the undoubted fact that it is believed in local Spanish circles, and, worst of all, upon the fact that among the workmen a belief is widespread that the abuse reaches upward into the English staff, many members of which are supposed to participate in the 'backsheesh' that is said to be levied right and left by contractors and foremen. It is not enough that the heads have clean hands, and would have their subordinates clean likewise. An alien administration to be respected must be like Cæsar's wife, above suspicion; the moment it falls under suspicion and loses prestige it commences to become hateful. It is well-nigh an impossibility for a great administration like that of Rio Tinto operating in a foreign land, with the ideas of which it is out of sympathy, ever to become really popular; but it was never so unpopular in times past as it has become during the past few years, and perhaps loss of respect may have more to do with increased unpopularity than would appear at first sight possible.

JOHANNESBURG.

Jupiter.—The closing-down of the Jupiter, the deepest mine on the Rand, no matter what official explanations may be given, cannot fail but to throw a doubt on the future success of deep mining. The Jupiter property consists of about 500 claims on the dip of the Geldenhuis Deep, the deepest portion of the workings exceeding a depth of 5000 ft. The issued capital of the company exceeds a million sterling, upon which one dividend of 5% has been paid. Owing to the prominence lately given to deep mining on the Rand by the unsatisfactory results attained at the Simmer Deep and the Cinderella Consolidated, the doings of the Jupiter mine have been much in the limelight, and it was only the other day that the board of directors considered it advisable to increase the milling capacity from 40,000 tons to 60,000 per month, with the object of reducing the average working cost per ton and adding to the total profits. As a matter of fact, the necessary loan for this extension of plant had not only been arranged, but tenders for carrying out the work had been called and accepted. However, the labour troubles of July, having affected the native labour-supply, caused the directors to

reflect and fully consider the new position, with the result that they have decided to close the mine down for the present.

The closing-down of the Jupiter is not in any way due to deep-mining difficulties, for, although a depth of over 5000 ft. vertical has been reached at the lowest point of the workings, the average working cost has not been



The old Consolidated Langlaagte Mill.

abnormally high, running only a trifle in excess of the average of the whole Witwatersrand, and considerably below the average cost of some of the shallower mines. It is, however, the result of the old trouble of grade declining with depth, a trouble somewhat too common on the Rand to allow deep mining prospects generally to be regarded with the complacency shown by some writers, and, moreover, a trouble that seems likely to increase in intensity as greater depth is reached. The Jupiter mine has always been a well developed property, while the group controlling its destinies has spared neither labour nor expense in equipment; but despite these advantages, the grade has continued to decline with depth at a greater ratio than it seemed possible to reduce the cost by large-scale working; in fact, if the mine is to be worked at all it has now become necessary to do so by milling 4 dwt. ore. For the past five years over 1,000,000 tons of ore have been standing developed in the mine, but the average grade has been constantly declining; for instance, in 1909 it was 6 dwt., the next year it fell to 5'8 dwt., and in 1911 to 5'7 dwt., while today, if the mine is to be worked, it becomes necessary to treat 4'1 dwt. rock at a profit. As before remarked, the closing of the Jupiter cannot but create a bad impression of deep mining prospects, although scarcity of native labour is officially given as the real cause. It must not be overlooked that most ultra deep

mines on the Rand suffer from a scarcity of native labour, but, had the average of the ore reserve been maintained at the level of four years ago, the result of a scarcity of native labour would not have been so apparent.

Oil Prospects.—The fact that the report of the oil expert, Mr. Craig, employed by the Government to examine and report upon the oil resources of South Africa, is not encouraging, causes little surprise in Johannesburg. For years company promoters have thrived on oil prospects in different parts of South Africa by trading on the ignorance of investors. Gas has been taken as an indication of the presence of oil by promoters, these displaying, as a rule, even more gas than the boreholes. The fact is that the geological structure of South Africa does not conduce to the occurrence of oil springs, while the proved deposits of oil-shale are too limited in extent to justify the laying down of the necessary plant.

Government Areas.—Some disappointment is naturally expressed locally at the poor value of the banket struck in the southwest shaft of the Government Areas during the month, where, at a depth of 3614 ft., the lode with a width of 30 inches only, assayed 3'8 dwt. per ton. After all, too much importance need not be attached to this evidence, in face of the irregular results obtained in the Brakpan property adjoining, as well as in the southeast shaft. After all, the shaft assays



The new Consolidated Langlaagte Mill.

in the Government Areas have exceeded anticipations, for, when averaged, they show 8'75 dwt. over a width of 34 inches. The northeast shaft, the first to intersect the banket, disclosed a lode with a width of but 21 inches and an assay-value of 7'7 dwt., while the northwest shaft, at a depth of 2395 ft., found the banket 31 inches wide with a value of 7'15 dwt. The southeast shaft, however, in what

was regarded as the least promising country, at a depth of 3580 ft., struck ore 57 inches wide with an assay-value of 16.5 dwt., so that, despite the poor results shown by the south-west shaft at a depth of 3614 ft., the average results of the deeper portion of the property are higher than those obtained in the shallower portion lying immediately on the dip of the Modderfontein. These results show that in the Government Areas the lode is highly erratic both in width and value, as is the case in the neighbouring Brakpan mine, where recent development results have been causing considerable uneasiness.

Coal Trade.—There has been a good deal of grumbling of late about the scarcity of railway trucks for the conveyance of coal to the distant markets. Since the Union of South Africa was accomplished, a drastic revision and levelling-down of railway rates has occurred, with the result that the markets for coal have been considerably extended. Formerly little Transvaal coal was sent out of the province, the Rand goldfield and the Central South African railways forming the only markets of any importance. The supplying of these distant and outside markets has naturally put a strain on the rolling stock of the railway, and there are bitter complaints made by the collieries that the administration did not foresee and prepare for this trade expansion. When the Government commission was investigating the probable effect of the Victoria Falls power scheme, the Coal Owners' Association came forward with evidence to show that the collieries would probably be ruined by the wholesale application of electrical power on the Rand, and that three out of every five tons of coal then produced would not be required by the gold mines. Naturally, evidence of this kind did not tend to encourage the railway administration to add to its rolling stock, but the fact is that the consumption and demand for Transvaal coal has increased considerably since the wholesale application of electrical power at the gold mines and the revision of the railway rates, thus completely falsifying the evidence of the Coal Owners' Association.

Several of the collieries in the Middelburg district have been complaining about the loss of a working day per month through lack of empty railway trucks. Such a loss as this is quite insignificant, and the collieries can easily provide against it at a trifling expense. Those who have had any experience in supplying distant and spasmodic coal markets know how essential to success it is to be able to stock

not a few hours' but a whole month's output, if necessary, and the Transvaal collieries ought not to have attempted to supply such coal markets without taking steps to store coal when rolling stock becomes scarce, as is unavoidable under the circumstances.

TORONTO.

Porcupine.—The management of the Dome Mines has abandoned the policy of reticence hitherto strictly maintained, and decided on giving out monthly statements as to production. Early in the month official figures were given covering the five months from April to August inclusive, showing that during this period a total amount of 53,885 tons of ore was milled, yielding gold to the value of \$519,666. The noteworthy feature of the statement is that the returns from month to month show a steady deterioration, the output for April from 9863 tons being valued at \$129,333, while the milling of 10,720 tons in August yielded only \$67,660, the average value per ton for the former month being \$13, as against \$6.31 in August. Since then the figures for September have been issued showing a slight improvement, the output from 10,790 tons of ore being \$70,135. The returns for the five months show a reduction in operating cost from the average of \$4.95 per ton in 1912 to \$3.86 per ton, which in August was further reduced to \$3.40. It is not expected that the new battery of 40 stamps will be in operation before March. The main shaft is now down to 425 ft. where a station is being cut for the 5th level. The Hollinger has completed its first dividend year, the total payments to shareholders amounting to \$1,170,000, or 39% on the capital. The operating profit during 15 months of milling, up to September 9, is estimated at about \$1,700,000. For the four-weekly period ending September 9 the gross profit was \$145,866. The number of tons milled was 12,264, yielding \$17.80 per ton. The extraction was 96.4% and the operating cost \$5.18 per ton. The most important feature of recent underground development is the discovery, on the 100-ft. level, of a vein supposed to be an extension of No. 1 vein at a distance of 250 ft. from where the latter was believed to have stopped. It carries 7 ft. of ore possessing the same characteristics as No. 1. Another vein struck on the 300-ft. level is believed to be a continuation of vein No. 8. The Pearl Lake has postponed the installation of its mill until the spring on account of the additional expense and difficulty of winter work. It will be a ball-pebble mill with a

capacity of 250 tons per day, and the extraction will be by the cyanide process. During the winter development will be continued down to the 1000-ft. level. At the Schumacher a new main working-shaft is being made by a rise from the 100-ft. level of the old workings. When it is timbered to the 100-ft. level it will be put down to 200 ft. deep. The 10-stamp mill of the Three Nations, after being thoroughly tested, is now in regular operation, treating between 40 and 50 tons daily. The Porcupine Miracle is installing a mill with crushing, ball-mill, and straight amalgamation equipment, having a capacity of 60 tons per day, and will add a cyanide plant in the spring. They have a large reserve of milling ore claimed to aver-

will be made to ascertain the most suitable method of cyanidation.

Cobalt.—Many of the Cobalt operators who have not regular contracts with Canadian smelters are experiencing difficulty in marketing their ore. The American Smelting & Refining Co., to whose smelters at Perth Amboy (New Jersey) and Denver (Colorado) a considerable proportion of the Cobalt ore was consigned, now refuse to take ores having more than 7% of arsenic. This bars out all the smaltite and much of the concentrate. Smelter facilities have during the past year been lessened by the closing-down of the Cobalt plant of the Canadian Copper Co. at Copper Cliff, Ontario, and that at Carnegie



THE DOME MINES, PORCUPINE.

age \$11 per ton. The Hollinger Reserve has been acquired by the Lewisoyn interests after lengthened negotiation.

Kirkland Lake.—A rich strike has been made at the Tough-Oakes property in this district, consisting of coarse gold in plates. Cracks in the face of the drift one-sixteenth of an inch wide are filled with gold, and the adjacent rock has a good showing of gold tellurides. The two Wiseman claims, adjoining the Tough-Oakes, have been bought by H. Cecil, representing English interests, and a new company has been organized to operate them, under the name of the Telluride Gold Mines, Ltd., capitalized at \$1,500,000. The Lucky Cross in the Swastika district has been re-opened under the management of G. F. S. Anderson, late of the Buffalo. An electrical power-plant will be installed. A 30-day run

Pa., and the burning down of the Orillia smelter. The remaining smelters are engaged nearly to their full capacity on contract work. In this emergency there is a disposition to look to Europe for a market, as in Saxony there are smelters, built for the treatment of ores similar to those of Cobalt, that have to import ore in order to keep in operation. The Orillia smelter is to be re-built, which may partly help matters, and other projects for meeting the difficulty are under consideration. The annual report of the Kerr Lake for the year ended August 31 showed a total income of \$1,182,493, an increase of \$138,075. After paying dividends, a surplus of \$237,315 remained, bringing the total surplus up to \$954,308. The production of silver was 2,109,975 oz., and the ore reserves were estimated to contain 6,000,000 oz. The cost

of production was 21'39 c. per ounce. The Coniagas has declared an additional dividend bonus of 3%, bringing the total payment up to 14%. When this is paid it will make the total disbursements of the company \$5,920,000, or nearly \$2,000,000 more than its capital. Stanley N. Graham, lately manager of the Peterson Lake, has resigned his position, having been appointed professor of mining engineering in the Technical College, Halifax, N.S. He is succeeded by John Baker, formerly of the Cobalt Lake. The Nipissing during September mined ore of an estimated net value of \$191,753, and shipped bullion and custom ore of an estimated net value of \$442,588. Owing to the great demand for smelting facilities a good deal of custom ore is being treated. The No. 63 shaft is to be put down to the 900-ft. level, as cross-cutting at the 650-ft. level shows the vein at that depth to be low in silver. Development at a greater depth will be undertaken to discover if pay-ore occurs below the conglomerate. At the Chambers-Ferland the No. 3 shaft, now down 135 ft., will be sunk to the 300-ft. level, where a drift will be run in the direction of the No. 64 vein of the Nipissing. The Casey-Cobalt has now 30 stamps in operation worked by electric power supplied from the Montreal river. High-grade ore is being stored until smelting conditions improve. The Beaver Auxiliary at Elk lake has encountered high-grade ore on the 200-ft. level of the new workings. A vein 2½ in. wide is stated to carry 6000 oz. of silver per ton. The Trethewey has taken a working option on what is known as the West Beaver property, at Silver Mountain in the Port Arthur district. D. L. H. Forbes, consulting engineer to the Trethewey, will have charge of operations there during the winter. The closing-down of the Wettlaufer, in the South Lorrain district, owing to the exhaustion of its ore reserve, has been hastened by an accident, three or four hundred tons of rock having caved-in, destroying the shaft between the first and second levels. Another South Lorrain prospect, the Bellelen, has closed-down for lack of funds.

Pacific Coast Collieries.—This company, in which British capital is largely invested, which has for some time been carrying on extensive development work on its coal areas on Vancouver island, has received at its head-office in Montreal highly satisfactory reports as to the work accomplished. The South Wellington mines No. 1 and 2 have reached an output of 800 tons per day. Two new

shafts on the same property are nearly completed, being some 650 ft. deep and fitted with a modern equipment, capable of producing about 1500 tons per day. At Suquash, on the northern shore of the island, a large staff of men is at work, and when the equipment is completed the capacity at this point will be 2000 tons daily. The South Wellington mines are situated about eight miles from water transport, the company owning its own railroad to Boat Harbor, which has been put in shape to handle a greatly increased output.

MELBOURNE.

Oil.—Not long ago Mr. Carne (one of the Government geologists of New South Wales) was lent to the Federal government to investigate the occurrence of oil in Papua. His report is not a convincing document, although it appears that seepages of oil can be traced in certain localities. There is nothing to show that the geological structure of the country is such as to afford great hope of petroleum being found in quantity. After dealing with this phase of the subject Mr. Carne discusses the possibility of oil being found in Australia. In this connection it may be mentioned that for many years past a considerable number of people in the Commonwealth have held that Australia lies within the petrologic belt extending from the East Indies to Timor and into Australia. At Roma in Queensland a bore sunk to a considerable depth resulted in a big escape of gas. In South Australia asphaltum has been found on the coast line, and in the Northern Territory, over 1000 miles away, traces of oil have been discovered, but the geologists all along have declined to accept these evidences as conclusively proving that oil exists in Australia. The strata are horizontal or have simply been faulted. There is not the dome-shaped anticlines that in other parts of the world have been proved so important a factor in conserving the underground supplies of oil. Quite recently an effort has been made in South Australia to form a syndicate to provide funds to carry out boring in certain selected regions where Tertiary deposits exist with the object of testing the country for oil. It seems almost certain that this project will gain a good deal of public support; if so, there is a chance that work will be conducted on the systematic lines required. Hitherto most of the search for oil has been done in a haphazard way and without any of the party being properly equipped scientifically. Only recently an oil expert declared that he had found the territory he wanted

in South Australia, and that he intended to go to the United States for the capital necessary to have it tested. When asked if any geologist had reported on his discovery, he gave an emphatic shake of the head and said he did not want any "damned geology man to teach him his business"!!

Dredging.—Australian capital is still being devoted to acquiring dredging properties in the Malay States and in the Philippines. In connection with Malay tin-dredging, the last flotation was the Kampong-Kamunting claim, about 6 miles from Ipoh, reported on by Messrs. A. W. Freeman, Bethune Horton, and Naish, all Australians and thoroughly trained men. The issue was made in Sydney with great success and it is intended to place on the properties two Australian-built dredges at a cost of £50,000. The whole enterprise is to be run under Australian conditions. Now word has come to hand that the same group of experts has approved of 170 acres at Kota near Larut. This property is estimated by Mr. Freeman to average 1 lb. of tin per cubic yard, and as dredging has been proved by the Tongkah Compound Co. to cost about 4½d. per cu. yd., it is easy to see that with tin at £170 per ton, a substantial margin of profit is possible, provided the testing of the ground is a proper index to its actual yield when dredged. The drift of capital from Australia to the East is an indication of the enterprise of Australians and of their desire to find fresh investment outside old established fields.

Mount Lyell.—Mining in Tasmania is going on steadily. The Lyell Blocks mine, which joins the North Lyell, has sunk a shaft to over 1100 ft. close to the boundary of the latter property. The importance of this work lies in the fact that the ore-shoots in the North Lyell mine have been underlying from the 850-ft. level rapidly in the direction of the Lyell Blocks lease. At 1100 ft., however, according to official reports, there seems to be some check to this movement, and it is thought that the direction of the ore-shoot has changed back into the North Lyell ground. This can only be demonstrated by actual exploratory work. The supporters of the Lyell Blocks Co. do not accept the statement that there has been any variation in the underlie of the ore-bodies, and they, therefore, are continuing to sink their shaft in the hope that at greater depth they will pick up the formation. On the other hand the Mt. Lyell people are most confident that the pitch of the ore will enable them to intersect it in their Lyell Comstock block. So far as the North Lyell is concerned,

it is now unwatered and is being steadily developed and worked. The output of the mine is increasing with the result that the company will soon be treating the former tonnage of ore. With copper at its present price a dividend for December should be assured.

Broken Hill.—There is nothing fresh in mining affairs at Broken Hill except at the British. There the company is endeavouring to prove the downward continuation of the



ore-shoot worked in Thompson's shaft. On this development the future of the property depends. It has to be admitted that up to the present the grade of ore developed in the British mine has not been nearly so high as was expected. The average has been nearer 13% than 14% of lead, and it has been a fortunate circumstance that the price of that metal has kept so high, while the company has been re-organizing the whole of its plant. There seems to be some expectation that the cost

will drop considerably below 20s. per ton, but with the experience of the South Broken Hill recently, it seems too much to hope that there is going to be so great a saving in treatment as a good many people assume. The works when completed will provide for a continuous extraction of the metals in the ore, and it can be admitted that as cheap work as is possible will follow. At present the formation in the bottom cross-cut at No. 11 level is rhodonitic and quartzose, and not sufficiently high-grade to inspire the greatest of confidence.

Copper mines in North Queensland seem to have fallen on rather hard times. The Mount Elliott had barely got started after the strike when a creep occurred and news came to hand that two of the levels were practically thrown out of use. It is difficult to find out exactly the extent of the damage because a close oversight is kept over the news that comes from the mine. It would appear that the creep is likely to stop development on the bottom level for a while and it is almost sure to interfere with dividends. The Hampden company has been compelled, owing to the dry weather, to use the mine-water for its smelters, with consequent leaky water-jackets. The Hampden mine itself is not developing any better, but good ore is being opened up below No. 5 level in the Duchess mine. Among the outside properties the Mount Cuthbert has succeeded in raising locally a considerable amount of capital, which should enable it to develop its leases without any call for money from abroad. The company at the present time has proved over £800,000 worth of copper ore in the Mount Cuthbert, Warwick Castle, and Mighty Atom leases. The State is constructing a railway to this company's mine and it is expected that communication will be established by June next. The Edmund Davis group in London is understood to have completed the deal over the Mount Oxide mine, which lies northwest of the Cuthbert. Hence the importance of the railway. The new company appears to be heavily capitalized, considering the distance of the property from rail, but there is said to be a substantial quantity of high-grade copper ore in reserve. W. H. Corbould has recently inspected the property on behalf of the London group, but of course his conclusions have not been made known on this side of the world.

Processes.—At Broken Hill work on the different flotation processes continues to advance in interest. It can now be said of the Lyster process that it has been commercially

established. On the South Blocks mine recoveries of over 85% of the lead have been achieved. This is a world's record for such work. The process has been acquired by the Minerals Separation. The process selectively separates galena from blende. While this process is the only one working on full commercial lines, there are several other methods for dealing with the slime being tried at Broken Hill. One of these is the Owen, which is being tested at the South mill and is expected to respond to anticipations. The Lyster process is continuous in operation while the Owen is more or less intermittent. Notwithstanding that, both involve similar technical methods such as the control of aeration and of certain solutions. Bradford, at the Proprietary mine, has been also working on a selective flotation process for the treatment of slime, and it is understood that his company will soon put up a working unit to demonstrate what can be done with it. It may be added that the Zinc Corporation is applying the Horwood process to the treatment of very refractory material. This product is the slimy residue collected after the treatment of the tailing by the Minerals Separation process and the tabling of the Minerals Separation concentrate. In consequence, it is a concentrated zinc slime in which the mineral particles are more or less oxidized owing to the fact that the original material comes from old dumps that have been standing for years in the open. Regular shipments of zinc concentrate, as the result of the use of the Horwood process on this class of material, are being sent away and all difficulties in connection with treatment have been overcome. This process should have an important application in the treatment of the Tasmanian pyritic ores, such as exist at Rosebery and Mount Read. It is gratifying to note that Broken Hill is still leading the way in the field of metallurgical research in connection with the flotation processes. The leaders are men like Bradford, Klug, Hylton, Lyster, McBryde, and Owen. The Zinc Corporation works on the South Blocks mine may be specially cited as carrying on the most progressive work. This is the case especially in connection with the development of the Lyster and the Horwood processes. It must be satisfactory to Mr. F. A. Govett and the Hoover brothers to know that the representative of Bewick, Moreing & Co. on this side of the world has been so successful in inculcating the staff with the desire to excel, as they have done, in this important branch of metallurgy.

LIMA.

Copper.—After several months' delay the new hydro-electric plant of the Backus & Johnston Co., 6 kilometres below Casapalca, has been successfully put into operation. The plant consists of two units of 1000 horsepower each, and a third unit in reserve. The water available is over 3500 litres per second, and the net fall 83'5 metres, which is led to Voith turbines through pipes 1'2 m. diam. and 180 m. long, direct coupled with 2000-volt dynamos. This voltage is transformed to 11,000 volts prior to transmission. A unique feature of the water-line is the system of settling-tanks at the intake. As the river

(tons), the smelter will treat about 12,000 tons of ore per month, according to the present intentions of the management. The company has been able recently to obtain about 8000 tons of ore per month from all its Morococha holdings, leases, and custom business. Plans are now being made, in view of the electric power that will be available, for an extensive campaign of development, involving the installation of power-drills. In addition to sinking the Natividad shaft to the 800-ft. level, a 8000-ft. adit (to be 10 ft. wide and 7 ft. high) will be driven to cut the veins now being exploited, in Cajoncillo hill, also serving outside properties with which arrangements



CARMEN OPEN-CUT, CERRO de PASCO.

brings down slag and tailing, it is necessary to get rid of them to avoid their scouring action and accumulation in the ditch; the water will pass through the same tank only on alternate days. The total length of the ditch-line is 1300 metres. As soon as the plant has been tested, the greater part of the power generated will be put immediately into use at the smelter, the balance to be transmitted to the proposed power-plant at the company's holdings in Morococha. The new converter-plant, including an electrically-driven Nordberg blowing-engine, will probably be started in the latter part of November, and blister copper will be exported, thus avoiding shipments of matte. This innovation will mean the discontinuance of shipments abroad of the higher-grade copper-silver ores from Morococha. In view of the present limited bin capacity (about 6000

have been made for ore that will be extracted. This adit will be the longest in the district and its results will have an important bearing as to the future of the district. The Government has appointed a commission to study the feasibility of a cross-cut adit from Yauli (a station on the main line of the Central railroad of Peru, at kilometre 195 from the port of Callao) to Morococha, to be 6 kilometres in an air-line and 300 metres below the lowest present workings in the district. This project is intended to serve for drainage as well as exploration purposes. Operations in Morococha are in better position again with the return of the labourers from their annual harvesting. Considerable activity, other than that already referred to, is manifest, and the previous freight-car famine has been alleviated.

The Magistral properties, inside from Chim-

bote, have been optioned by local people, who intend to develop the property so as to interest foreign capital in the enterprise. The ore is a mixture of chalcopryrite and pyrrhotite, averaging 5% copper (readily sorted to 8% copper) and carrying a little gold and silver, in a contact metamorphic zone between limestone and andesite. The width of the mineralization is stated to vary up to 100 metres. A 30-ton brick furnace has been in service spasmodically using local anthracite (said to be abundant) as a fuel. The workings are not extensive. The distance of the property from kilometre 76, on the Chimbote-Recuay railroad, is 90 kilometres. The intervening topography is rugged.

Gold.—Considerable outside attention is being given to the possibilities of gold mining in Peru, extending from the concession granted to a strong syndicate in London, covering the headquarters of the Marañon river, close to the Ecuador boundary, to the concession covering the tributaries of the Inambari river, in southern Peru. The first mentioned concession, covering dredging ground, met with some opposition before it was obtained, due to the location being in questionable territory. This point has evidently been over-ridden, for a prominent engineer, lately of South Africa, has been examining the ground for some months and is returning to the coast. It is known that native washings exist, otherwise information concerning the region is meagre. The concession does not conflict with the Koppel concession, obtained several years ago in connection with the proposed railroad from Paita, on the coast, to the navigable waters of the Marañon which flows to the Amazon. The concession in southern Peru, also covering dredging ground, is being more actively investigated by a syndicate from California; recently 30 tons of drilling machinery, and accessories, were shipped inside. The preliminary work has been satisfactory. If the extensive holdings are found to yield profitable returns, it will be necessary to build a railroad to the field, beginning near Tirapata, a station on the southern railway of Peru. At Viscachani, in the district of Sandia, department of Puno, the hydraulic operations of the Compañia Aurifera Argentina Peruana are being conducted profitably after several years of less successful work. There appears to be a scarcity of water as delivered. The Aporoma Goldfields, an English company, is not operating regularly; rumours of the cessation of all work have been circulated. It appears that an additional ditch, costing fully £20,000,

would relieve the water situation so as to enable continuous work to be carried on, but the funds for such an expenditure are not available. This property also is in the Sandia district. The Santo Domingo, which has been the premier gold mine of Peru, in the adjoining district of Carabaya, has recently been optioned to Argentine parties. Meanwhile a small amount of work is being done in the mine, and the mill is treating, in addition, the tailing of previous years' work. The Montebello mine, situated about six miles from Santo Domingo, which was shut-down for several years after a short blaze of local glory, has been optioned by the same people. If the outcome of the present investigations is favourable both properties will be developed simultaneously. In the department of Apurimac, district of Cotabambas, the Cotabambas Auraria has been obtaining profitable results at Cochasyhuas. The present plant, consisting of 10 stamps and a Huntington mill, is treating 16 tons of sorted ore per day. The bullion shipments are only from the amalgamation recovery, although the cyanide annex has been tried, but is apparently not in full running order as yet. In contrast to the above, judging by the decline in the price of the shares and the failure to produce the monthly bullion shipments predicted, are the operations of the Andaray-Posco company in the province of Condesuy, department of Arequipa. The two Lane mills are not being supplied with the tonnage they could treat. Only one mill is working, handling about 16 tons per 12 hours, and the free milling portion of the gold contents is recovered. Further northward, near Nazca, the centre of a pre-Inca civilization, a gold vein, said to average 8 oz. over a width of one foot, is being opened up. This property is not favourably located as regards water for milling purposes; it is within 60 miles of the Pacific Ocean. The New Chuquitambo Gold Mines, near Cerro de Pasco, continues to produce about 300 ounces of gold per month, treating from 80 to 100 tons of ore per 24 hours, in the 40-stamp mill. The cyanide plant is still inactive. An incline is being sunk, from the lowest of the three tunnels, and is 40 metres long at present. About 140 men are employed in the mine and mill. Exploitation is chiefly by open-cut. The Huallaga river has been recently denounced, along that part of it that is about 4 days horseback ride from Cerro de Pasco, for the account of a New York syndicate. The region is below the ground controlled by the Ambo Gold Mines Co. (mentioned in the September

issue), and is expected to be a dredging proposition. The ground has been tested superficially. The test-holes did not reach bed-rock. The Santa river, in the district of Santa, department of Ancash (inside from Chimbote) which has been held for several years as possible dredging ground, is still in the stage of negotiation on the part of the owners, who are endeavouring to sell. A limited amount of prospecting was done, but bed-rock was not reached. There is no other gold mining of note, except the work in the Potaz district (inside from Chimbote), one company having recently shipped a small Hardinge ball-mill to its property.

Oil.—The interest displayed in the Peruvian oilfields, already mentioned in these columns, has taken a definite form with the announcement that the Standard Oil Company has acquired control (60%) of the London & Pacific Petroleum Co., through the action of Sir A. Williamson. The shares of the late Mr. William Keswick were bought, and endeavours are under way to purchase the minority shareholders' interests. It is stated that shares of the Standard Oil Company were exchanged for the Keswick holding, and that between £300,000 and £400,000 will be spent in improvements, principally a refining plant capable of turning out 200,000 cans of kerosene and gasoline per annum. This expenditure is to be for the account of the Standard Oil. The Talara and Negritos districts are thus controlled. These lie about 40 miles north of Paita, the most interesting seaport in northern Peru. At Talara are the present refinery and shipping wharves. The total annual production has been about 100,000 tons, but within recent months this has been increased to the rate of nearly 170,000 tons. The Lagunitas company, which is operating on leased ground of the London & Pacific Petroleum Co., has been selling its product to the Standard Oil. Its annual output has been increasing, and now amounts to over 30,000 tons. The Inca company is another lessee working on London & Pacific ground. The Lobitos Oilfields Co., which is controlled by Sir A. Williamson (of the firm of Williamson & Balfour), is producing nearly 80,000 tons per annum. This company is obtaining its best results from the deep sand, over 2000 ft. holes, and recent work of the London & Pacific drills has met with similar satisfactory returns. The Zorritos property, owned by Faustino G. Piaggio & Co., is an outside producer, which is responsible for an output of 15,000 tons yearly. The property lies 24

miles south of Tumbes, a port near the Ecuador border, and includes a refinery plant and accessories.

CAMBORNE.

Dolcoath.—It will be recalled that at the half-yearly meeting held in August, the manager announced the intersection of the South Entral lode in the cross-cut north from New Sump shaft at the 210-fm. level, and that for the distance then driven, the lode had averaged 35 to 40 lb. black tin per ton. Now comes the news that the cross-cut north at the 190-fm. level has intersected a lode, which, over a width of 6 ft., assays 60 lb. black tin per ton. At the meeting the manager anticipated that it would probably be six months before the South Entral lode could be reached at the 190-fm. level, so if this is the same lode as found in the 210-fm. level, it would appear that the lode has been faulted. It is officially stated that at present no definite opinion can be formed as to the connection of the new discovery with the South Entral lode found at the 210-fm. level.

Wheal Kitty & Penhalls.—Like the neighbouring property, West Kitty, this mine has shown improvement during the past few months. For the twelve weeks ended September 27, the sales of black tin amounted to 49 tons from a tonnage of ore milled of 3547, or a recovery of 31 lb. per ton. This compares with 3587 tons of ore milled, producing 33 tons of black tin, or a recovery of 20·6 lb. per ton, for the first twelve weeks of 1913. Although the monetary value of the sales is not published, it is evident from these figures that despite the substantial fall in price, the result of the current half-year's working is likely to show a much improved state of affairs financially. The development footage is down somewhat, due to a dearth of miners. The drifts on the Wheal Kitty lode at the 730-ft. level from Sara's shaft are being extended with all speed, the end west by rock-drill. This end has of late given the best results, the lode averaging 18 in. in width and 60 lb. in content. At Wheal Vottle a nice bunch of tin has been opened up at the 24-fm. level, and this is now the best point in the mine.

Geevor.—In my last letter I stated that a separate company was to work a portion of the undeveloped area of the Geevor. This has now been formed, the Geevor Extended Tin Mines, Limited, having been registered on October 21 with a nominal capital of £50,000 in shares of 5s. each. The working capital has been privately subscribed.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Oct. 1913	Sept. 1913	Oct. 1912
£73. 9s. 5d.	£73. 5s. 3d.	£76. 10s. 7d.

While on the one hand the attention of the market has been drawn to the continued decrease in stocks, prices on the other hand have been under the influence of the strained relations between the United States and Mexico. These opposing factors have imparted a steady tone, and have kept us free from a slump, in the general depression, as well as from rash optimism. Anticipations of trade declines are growing, and there are signs that speed is slackening. It is, however, only the comparison with recent high records that gives room for dissatisfaction, and copper consumption today compares favourably with that of previous years. Further depletion of stocks, already at a dangerously low level, will be a misfortune, and while Mexican disturbances are curtailing industrial development they are at the same time responsible for some diminution of supplies. American refineries have freely drawn upon English standard copper to replace this shortage.

Standard copper was sold as high as £75. 5s. for cash, but the end of the month saw a decline to £73. 7s. 6d. for cash and £72. 2s. 6d. for three-months. The widening of the backwardation is noteworthy and indicates the extent of the bear movement. The decline may go still farther, for in addition to the general expectation of trade retrogression, it is felt that production, arrested by temporary causes, will speedily increase and outstrip consumption once more.

TIN.

Average prices of cash standard tin :

Oct. 1913	Sept. 1913	Oct. 1912
£185. 0s. 3d.	£193. 7s. 7d.	£228. 9s. 1d.

Trading has been featureless, prices ranging within narrow limits. Predictions early in the month of an improved statistical position based upon small Straits shipments were not realized, and the slight animation that these predictions engendered soon died. Speculation in tin is non-existent. The tinplate trade shows signs of regaining activity, but American demand is disappointing, while reports from there as to trade conditions are conflicting. Some uneasiness is expressed as to the effect of the new Tariff Law. The large operators are ignoring the market. The

contango has widened to 25s. in the absence of manipulation. The future of prices is largely dependent on developments in the United States, and these give little hope of improvement for some time ahead.

LEAD.

Average prices of soft foreign lead :

Oct. 1913	Sept. 1913	Oct. 1912
£19. 9s. 5d.	£19. 14s. 10d.	£20. 8s. 0d.

Lead has ruled steady and high. The Russian demand has continued to exercise a leading influence on the market, for the demand from there has continued right up to the end of the month. A strike has broken out at the Sopwith works, and the prospects are that the struggle will be a lasting one ; on the other hand preparations are reported for increased output from other Spanish producers. On the whole buyers may reasonably hope that a relief from the period of high prices is in sight. Dealers, having anticipated the fall already, have been rather severely punished for their temerity. There was a substantial bear account open for October, which was covered with difficulty, and there is a good deal to buy for November.

SPELTER.

Average prices of good ordinary brands :

Oct. 1913	Sept. 1913	Oct. 1912
£20. 13s. 9d.	£21. 3s. 10d.	£27. 5s. 10d.

The market has been uneventful, with a drooping tendency. Buyers are reserved, and speculators have still to realize their late purchases. First hands are not inclined to make concessions, their stocks at works having been considerably reduced in the last two months, and being expected to decline further by the end of the year. The decline for the month amounts to about 10s. per ton.

OTHER METALS AND MINERALS.

Prices quoted on November 10 :

SILVER.—27½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£81 to £83 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£28 to £30 per ton.

QUICKSILVER.—£7. 5s. per flask.

MANGANESE ORE.—9½d. to 11½d. per unit.

IRON ORE. — Cumberland hematite 23s. per ton at mine. Spanish 19s. 6d. delivered.

PIG IRON.—Cleveland 51s. per ton. Hematite 64s. 6d. per ton.

WOLFRAM ORE.—34s. per unit (1%).

DREDGING DISCREPANCIES

Errors in Estimates. Insufficient Testing. Bank Measurements.
Capacity of Dredge. Labour. Transport.

By D'ARCY WEATHERBE.

ALTHOUGH the following notes may not be of immediate value to the engineer engaged in alluvial mining, it is hoped that to the non-technical director and other persons who have to do with the management or direction of such enterprises, they may illustrate reasons, more nearly obvious to the engineer, for the disappointing results frequently occurring in an industry that should be a relatively safe form of mining venture.

Several cases have been observed recently where the returns from tin and gold dredges have been widely at variance with the value estimated in previous reports on the properties. By the use of modern methods in testing alluvial deposits, and provided that sufficient funds are available for thoroughly examining the ground, there should be little excuse in most cases for such variation. An analysis of the commoner causes may be instructive.

In one instance, a prospector, who was a good panner and a man who had been present at most of the gold rushes of the past 25 years, was sent to a remote country by a London syndicate to report on a gold-bearing river. A fair number of pits were sunk, in some cases to bed-rock, but in most, where the water was too heavy, the pay-gravel was not reached. He furnished a report, which, though in accordance with the circumstances stated, expressed a glowing opinion of the richness of the deposit. The evidence of the richness of the property was not sufficient, but a member of the syndicate had been advised that the only infallible method to prove the value of placer ground was to drill it, and consequently a young man was sent out, who, though a capable drill-man, had had no experience in dredging. The work was carried out systematically from a topographic point of view, but, admitting that the panning results were correct for the quantities of gravel washed in each case, it was most unlikely that such a man could make correct deductions on which to base the probable recovery by dredging.

As it was, the average value reported was good, and a small dredge purchased *from the stock* of a dredge-building firm was sent out and erected. The value recovered by the

dredge proved to be 30% lower than the figure given in the report, and as the capitalization had been based on a sanguine interpretation of the prospecting value, the business was a complete failure.

A number of years later a larger area, including the above property, was examined for other people by a well-known engineer, but, as insufficient money for thorough work was furnished, only a few lines of drill-holes and pits were put down at long intervals apart. In his report the engineer stated that, although the actual results of his prospecting showed a



1. Manchurian Chinese Alluvial Miners.

value of 1s. 4d. per yard, the bed-rock was irregular, and the ground patchy, and that much more work was necessary to delimit accurately the dredgable area and to estimate closely the average return to be expected from dredging. The report was taken as sufficiently favourable to warrant the organization of a company. A modern dredge was installed. At the end of the first year's work the average recovery was 1s. 10d. per yard, or about 35% more than estimated.

In these three cases the reasons for the discrepancies are easily traced to false economy in preliminary expenditure, but the ultimate cost was much more than if a thorough examination had been made in the first instance, to say nothing of the waste of time and money

in the original installation. In the first and second cases incompetent men were employed either through ignorance or due to the penny-wise-and-pound-foolish policy that produced the inaccurate assumptions made by the promoters from the third examination. Fortunately for the shareholders in this last case the results were larger than anticipated, but this may be ascribed to good luck, and the future may hold in store much disappointment.

Another typical case occurred where the ground was carefully examined by drilling and pit-sinking. The bed-rock was soft, clayey, and irregular, and in some cases it was even difficult by drilling to determine its junction with the gravel. The deposition of the gold varied in its vertical relation to bed-rock, and in most places there were two distinct gold-bearing layers. The lower one, close to the real bed-rock and the richer, was absent where the bed-rock was high. The upper pay-gravel, which lay on a thin layer of clay (false bed-rock), was of just sufficient richness to warrant working the ground, if an unnecessary depth was not dredged at those points where no gold occurred below. In the engineer's report, detailed information was given as to the depths of holes, water-level, depth of bed-rock, etc., and also the estimated *dredging depth* in each case, and his calculations as to yardage gave due consideration to this last factor. A dredge was placed on the property and a so-called 'practical' man was put in charge of the work, but the report and the carefully prepared plans and sections of the examining engineer were ignored, probably because of the manager's inability to understand them. The yardage actually dredged by the erstwhile winchman, whose fixed, but in this case fallacious, idea was invariably to dig into bed-rock, was largely in excess of what was necessary, and the natural result of moving barren ground containing a quantity of sticky clay was a greatly reduced yield per yard, notwithstanding the fact that the preceding examination had been most carefully and competently made and the advice tendered in it correct.

There has always been discussion between advocates of shaft-sinking and those of drilling as to the best method of prospecting dredging ground. In practice both methods are successfully used by capable engineers, and a combination is often employed, the choice of method depending upon many conditions not necessary to enter into here. As a matter of fact, the method matters much less than the intelligence and care with which

the work is carried out, but in any event a thorough appreciation of the principles of sampling and the special objects in view in the particular case, combined with a thorough practical experience, are indispensable to accurate and useful results.

Even when the best engineer and sufficient money for an exhaustive examination are furnished, some discrepancies are not unavoidable, but if his advice is strictly followed in the further exploitation of the property, or, better still, if his services are retained in a consulting capacity, at least until production commences, such discrepancies should be greatly minimized.

A fruitful cause of differences between prospecting and dredging returns is incorrect bank measurement, especially when the surface is under water. In lode-mining examinations, the estimates of ore reserves are made by surveying, usually with insufficient data to go upon, but the actual output afterward can be more accurately checked by weighing. In the yardage approximations of placers, methods of measurement analogous to surveying are also used, while the check after an area is worked out is done by a method no more accurate.

In reporting it is useful to express the estimate of value in terms of cubic units, and also in terms of units of surface area, that is, per acre or per block of arbitrary size, the blocks so expressed being each identified on the plan. The smaller the blocks (in reason) the better, but the area of each should bear a more or less fixed relation to the detail in which the prospecting has been carried out in that block and to the regularity or otherwise in the distribution of the gold, tin, or platinum, in the alluvium. The more holes or shafts to the acre and the more regular the distribution of the metallic contents the smaller the size of the blocks should be.

In testing dredging ground many cases occur where the estimates for average value are, to a varying extent, computed from the *weights* of gravel, and an arbitrary factor is often used in converting this to the cubic unit. Results by this method may be just as lamentable as those produced by using an arbitrary factor for the specific gravity of an ore in calculating ore reserves in a lode mine; in fact more so, as the yield per unit, and consequently the margin of profit, is usually so very much lower in gravel deposits than in lodes. Moreover, there is less excuse for mistakes in the placer, as its mass is more homogeneous, and its ratio of weight to bulk and its exact

extent are more easily determined. In one case, however, I found a variation of from 1600 lb. per cubic yard in material near the surface to nearly 3600 lb. in deeper gravel in the same vertical section. Such variation is extremely rare, and such a vertical change,



2. Ox-Carts in the Neuquen Desert, Argentine.

which would be more or less common to the deposit over its whole area, would be due, as in the case mentioned, to an easily observed physical change in the material, as, for example, the overburden of tundra in Siberia or the so-called 'muck' in Alaska. In using the weight method the greatest precaution must be taken between wet and dry material, and in the cubic method the average ratio between gravel *loose*, and *in place* must be fixed by actual tests. Wherever possible a unit of volume *in place* should be used in the actual testing, but it is always advisable to determine the relation between this and its weight.

In computing the capacity of an imaginary dredge that at the moment of calculation does not exist, only experience and the utmost thoroughness in testing and observation will serve in order to make the proper allowances for lost time and capacity, due to mechanical reasons, to clay, boulders, uneven surface, or irregular and hard bed-rock, or where constricted or awkward areas might necessitate leaving ground unworked on account of frequent turning or change in the position of the machine.

All these factors and many others affect the ratio of recovery to prospecting value; and, of course, affect the cost per yard. Rocker, sluicing, and other tests with and without quicksilver, in conjunction with panning and careful examination of the tailing, materially assist in the final estimate of the probable recovery by the dredge.

To give a reliable estimate of the future

working cost, it is essential that the examining engineer has had previous experience in mine management; considering the varying conditions of transport, labour, and climate, etc., under which the industry is now carried on in all outlying parts of the world, the more of this he has had, the better he is equipped.

Work under tropical conditions such as are found in the Malayan peninsula, the Gold Coast, Colombia, and similar places, does not fit an engineer for examination work in the Arctic or sub-Arctic regions, nor is the engineer whose practice has lain only among such placers as cover thousands of square miles of platinum and gold-bearing ground in the Urals, Siberia, Alaska, or the Yukon equipped for work in the tropics.

Besides the mechanical difficulties incidental to seasonal or permanent frost, the short season, varying from four to six months, which is available for transport, construction and working, greatly augment the initial capital outlay necessary for equipment, etc., while estimates for working cost or profit must often allow for thawing gravel, and for decreased capacities and increased loss of metal. Fixed charges accumulate during the winter period of enforced idleness, and must be consequently allowed for, though in Russia and Siberia a good use may be made of these periods in many ways that only experience can teach.



3. Llama transport in Bolivia.

Initial capital is largely increased in these northern countries by the enormous machines now employed, weighing sometimes up to 1200 tons each, not including the hull, which requires as much as 750,000 B.M.F. of Oregon pine.

Engineers accustomed only to dredges of this type, equipped with buckets of from 13 to 16 cu. ft. capacity, find it hard to believe that there is true economy in equipping good properties with such comparatively light and cheap machines as have recently been producing excellent results in the old tailing and light gravel of Oriental tinfields, notwithstanding the fact that there, on the Gold Coast, Nigeria, and in the northern republics of South America, buried timber is a common obstacle to high yardage capacity, which is the real secret of low costs in dredging.

The effects of intense cold or heat, extreme altitudes and unhealthy localities tend largely to increase the item of salaries and wages, and to reduce the efficiency unit. The effect of any one of these conditions is sometimes alone sufficient to ruin the prospects of an enterprise by the excessive amount spent in the above items, travelling expenses, and above all in lost time and expense incurred at critical periods by frequent changes in staff and skilled labour.

These factors can only be intelligently appreciated by the engineer who, by experience or careful study, has learnt how to remove or suitably prepare such unfavourable local conditions before the arrival of plant and staff for construction work. The lessons of Panama are an example of such efficient organization on a gigantic scale.

Long dealing with a single nationality or class of workmen is apt to crystallize the attitude of an engineer toward labour in general, and his estimates of the mental or physical efficiency of a new type may be misleading. The more efficient the original type to which he was accustomed, the more intolerant is he liable to be in dealing with the new, especially when his experience of it is only gained during the opportunities provided by examination work.

Experience only with the comparatively cheerful disposition of the Chinaman, Malayan, Korean, or Negro, and their comparative amenity to discipline may suffer rude shock in first contact with such a dour individual as the Russian peasant. Or the contrast provided by the lazy, plausible, and sometimes treacherous Spaniard or Latin-American, and the energetic and more businesslike character of the Canadian, American, or Cornish miner is so marked as to make previous experience essential in gauging human capacity.

Methods of transport and its cost vary greatly in different countries, capacity and speed being the chief cost-controlling factors.

Steamers on the sea or on large rivers or lakes have their antitheses in canoe, small boat, and raft on inland waters, while the makeshift for railways is road traffic by tractor, cart, or sledge. In rough mountainous country and on the desert or jungle trail, pack-transport predominates, and its various forms cover a wide variety such as porter, donkey, llama, mule, camel, elephant, reindeer, and dog. The extreme range in cost per ton involved in the above examples or their combinations makes it obvious even to a novice how the transport question alone might cause an enterprise to be abandoned.

On taxes, royalties, and Government exactions and the attitudes of Governments and their officials and the extent to which these may be evaded, ameliorated or met, often depend the success or otherwise of an undertaking. In all such matters as the above and in elucidating titles, tact and a knowledge of the language and customs of a country are of great assistance to an engineer in making his forecast.

Careful study of the water conditions for power, flotation, boilers, or washing may save an enterprise from failure or at least from a much larger capitalization than was anticipated.

Of all classes of mines, except, perhaps, certain coal seams or easily accessible bedded deposits, dredging areas offer the least excuse for inaccurate sampling, and the fact does not seem to be generally recognized, or at least, sufficiently appreciated, that a thorough alluvial examination in most cases eliminates the future charge against a property involved in the items 'prospecting and development' which occupy such a prominent place in the cost-sheet of nearly every other form of mine. Engineers, however, are not magicians, the views of some individuals to the contrary, and it is perhaps also not clearly comprehended that the deductions in a thorough and well-made report are first of all the results of practical management and general experience and the faculty of applying it to the problem in hand, and, secondly, of the hardest kind of work. The relative value of these qualities in one case as compared with another mainly differentiate between engineering efficiency and incapacity.

Unfortunately for the engineer the version of his views given to the prospective shareholder does not always accentuate the fact that his report is only a preliminary one, adequate facilities not having been afforded him to do the thorough work warranted. The



4. DOG TRANSPORT ON THE OKHOTSK SEA.



5. QUICHUA CARRIER IN PERU.

prospectus may quote the opinions of a host of individuals not qualified to pass upon the matter, or it may reflect the optimistic interpretations of sundry directors. When facts afterward prove the prospectus to be unjustified, the engineer is often given the blame without having had the responsibility.

Many more photographs might be added if space admitted, but those given will serve to emphasize my remarks relating to labour and transport.

(1). This shows a group of coolies from the Chefoo district, which provides some 100,000 miners and labourers in the Amur and Maritime provinces of Eastern Siberia. This class provides an individual physically far stronger and more energetic than the southern Chinaman, who, however, is supposed to be cleverer and more adaptable as carpenter, mason, or mechanic.

(2). The head of the Great Southern Railway of Argentina is at present in the territory of Neuquen. From here north and northeast to the Andes lies a great stretch of undeveloped and sparsely inhabited country providing little fodder or water for animals. Wagons drawn by mules and oxen constitute the method of transport, and in summer these usually travel only between sundown and sunrise on account of the intense heat. From the town of Cordero to Chosmalal, in the foot-hills, the trail is nearly 300 kilometres long, and the journey in summer takes from 11 to 12 days. Six oxen haul 1.5 metric tons.

(3). The llama belongs to the same wool-bearing family as the *guanaco* and *vicuña*, but is the only one of the group that has been domesticated. Used by the Inca tribes, the llama still forms a valuable factor of transport in the highlands of Peru and Bolivia. His carrying capacity is only about 100 lb., and his speed is rather less than a pack-mule.

(4). In Eastern Siberia, especially on the seaboard and among the extensive maritime rivers and lakes north and west of the lower Amur, the dog-sled forms a valuable adjunct to reindeer and horse transport, and in many instances is used for the Government mail service. Teams of from 7 to 13 are used, and 11 dogs will, with fair going, do 70 versts (45 miles) per day and carry 10 poods (360 lb.), with a passenger, on the sled. A reindeer when packed carries only two poods (72 lb.) dead weight, but is better in deep snow than the dog.

(5). In high Peru extraordinary feats are accomplished by the Quichua Indian, who

can go for days with heavy loads and for incredible distances subsisting only on a few handfuls of parched maize and a pouch of dry coca leaves. Articles, such as pianos, that could not have possibly been moved in such a country by any other means, have occasionally been taken for hundreds of miles over trails, steep, narrow, and rough, on the backs of a group of these Indians. The photograph illustrates one of these men on the old Inca road from Cuzco to the north, carrying an enormous load of *alamo* (poplar) branches.

(6). This view of pack-mule transport in the Cordillera region, shows a sight too common in any mountainous country to need special comment.

(7). A somewhat unusual difficulty of steam road-traction is illustrated, the heavily loaded wagon of a large tractor being shown off the track on a typical road in the forests of Eastern Siberia. The *nakatniks* (poles) with which these roads are corduroyed are cut in lengths suitable for *telega* or *tarantass* traffic. When they rot or break they are not soon replaced, and the resulting conditions cause such occurrences as are here shown.

The Royal Mint report shows that during 1912 30,248,742 sovereigns were issued, and 6,203,015 half-sovereigns, making a total value of £33,350,249. The gold bullion delivered to the Mint during the year was worth £33,062,768, and in addition light coin to the value of £3,216,856 was received. The amount of gold coin held by banks in the United Kingdom on the last day of June 1912 was £60,640,681. The silver coins issued during 1912 had a face value of £2,455,575, of which £544,966 was in half-crowns, £753,781 in florins, £758,680 in shillings, £282,270 in sixpences, and £115,877 in three-penny pieces. Of bronze coins issued the total face value was £323,235, or double the average of recent years. Of this amount, £70,000 in pence was coined at Birmingham. The number of pennies issued was 65,155,200, of half-pennies 21,324,000, and of farthings 7,036,800, or a total of 93,516,000. During the operation of coining, gold to the value of £14,171 was lost, chiefly in the course of melting, and to a smaller extent in annealing. Of this amount £3140 was recovered on the sale of 'sweep.' The report contains details on this subject; also some technical information on annealing, by T. Kirke Rose, and on the recovery of silver in the chlorine refining process.



6. MULE TRANSPORT IN THE ANDES.



7. ROAD TRACTION BY STEAM IN SIBERIA.

THE PITTSFIELD OIL-FIELD

By WILBUR GREELEY BURROUGHS.

THE Pittsfield oil and gas field is in Lorain county, 35 miles southwest of Cleveland, and $1\frac{1}{2}$ miles southeast of the town of Oberlin, in Ohio. The area so far tested extends 2 miles north and south by $1\frac{1}{2}$ miles east and west.

Geology.—The top rock formations are the Berea and the Bedford, of the Mississippian period corresponding to the Lower Carboniferous series. Thus far, the wells have started in the Bedford shale, after penetrating the Glacial drift, the Berea sandstone having been eroded



Fig. 1.

The surface is level, save where streams have slightly dissected the plain, as shown in Fig. 1. The smoothness of this plain is due to the drift that was deposited by the ice during the Glacial period. Before this deposition, the region was one of considerable relief, having suffered a long period of erosion. The drift, by filling the valleys and all irregularities, rejuvenated the topography.

prior to the Glacial period. Within $1\frac{1}{2}$ miles eastward, however, there is a Berea sandstone quarry, while to the northward, and in Oberlin to the northwest, the same sandstone occurs, showing that the absence of the Berea formation in this area, so far as developed, is merely local. About 9 miles northwest of the oil-field, at South Amherst, Bedford shale comes to the surface in the river valleys, while 2 miles

farther north the Cleveland shale is exposed and continues as the top formation to Lake Erie.

The table [on the next page] of the Geological Scale of Ohio exhibits the position occupied by those formations, through which the drill passes on its downward course to the Clinton formation of the Silurian, in which is found

classed together as the Hudson River Group.

The records of several of the wells are tabulated below, using the drillers' names for the formations penetrated. From these sections can be ascertained the particular local conditions encountered in drilling within this area. The records from the remaining wells are similar to those here given.



Fig. 5. WELL No. 7 BLOWING OIL.

the sand containing the oil and gas.

The names of the Devonian formations—Delaware limestone, and Columbus limestone—were classed as late as 1893 in Ohio State Geological Survey reports under the general heading of Upper Helderberg, or Corniferous Limestone.

The Monroe formation, of the Silurian, was called Lower Helderberg, or Waterlime.

The Richmond formation, Lorraine formation, and Eden shale, of the Ordovician, were

Well No. 1.		Well No. 2.	
Feet from the surface.		Feet from the surface.	
92	Drive pipe	145	Drive pipe
170	Showing fresh water	185	Water
890	Top of limestone	925	Top of Big Lime
1130	Water	2112	Bottom of Lime
1150	Water	2142	Top of Shell
1171	Big water	2172	Bottom of Shell
1500-1600	Soft lime-shale	2202	Top of Clinton sand
	Salt water	2230	Bottom of Clinton sand
2060	Bottom of Lime		

GEOLOGICAL SCALE OF OHIO.

	Names of Formation	Thickness in Feet	Kinds of Rock
.....Unconformity			
Permian	Dunkard	525±	Sandstones, generally massive, shales, limestones, and thin coal seams; non-marine, at least in part.
	Monongahela	200—250	Shales, limestones, sandstones, with important beds of coal.
Pennsylvanian	Conemaugh.....	400—500	Upper part mainly shales; lower part sandstone, with some shale and limestone.
	Allegheny	165—300	Shales, limestones, sandstones, with important coal seams.
	Pottsville Conglomerate ...	250±	Light-coloured sandstones and conglomerates, with some shale and a few coal seams.
.....Unconformity			
Mississippian	Maxville limestone.....	25±	Fossiliferous limestone, often brecciated.
	Logan group	100—150	Sandstone, massive conglomerate, and shale.
	Black band conglomerate ...	50—500	Sandstone and fine conglomerate.
	Cuyahoga shale	150—300	Light-coloured, argillaceous shales, with thin beds of sandstone. Shale characterized by ferruginous nodules.
	Sunbury shale.....	5—30	Black bituminous shale.
	Berea grit	5—217	Sandstone, used for building-stone, and for grindstones; locally carries oil, gas, and brine.
Devonian	Bedford shale	50—150	Thin beds of shale; occasional thin beds of sandstone.
	Ohio shale	300—2600	Mainly black, or dark brown, shale.
	Olentangy shale	20—35	Blue, highly fossiliferous.
	Delaware limestone	30—40	Blue, thin-bedded.
	Columbus limestone.....	110	Light-coloured, often containing chert masses.
Silurian	Monroe	50—600	Compact magnesian limestone, usually poor in fossils.
	Niagara group	150—350	Light-coloured shale at base, dolomitic limestone above, and a thin bed of sandstone at the top.
	Clinton limestone (outcrops in southwestern Ohio)...	10—75 in outcrop	Crystalline, locally replaced by iron ore.
	Clinton formation in central and northern Ohio ...	75—150± under cover	Limestone, sandstone, and shale, interbedded.
	Medina shales.....	50—150	Red, or yellow non-fossiliferous shale, with local thin beds of sandstone. Some thin bedded limestone.
Ordovician	Richmond	300±	Alternating beds of shale and limestone, highly fossiliferous.
	Lorraine	300	Alternating beds of shale and limestone, highly fossiliferous.
	Eden (Utica) shale	250	Black.
	Trenton limestone.....	130	Light to dark blue, crystalline, massive bedded and fossiliferous; the most important oil and gas horizon in Ohio.

Feet from the surface.		Feet from the surface.		Feet from the surface.	Well No. 5.	Feet from the surface.	Well No. 6.
2090	Top of Little Lime	2280	Bottom of hole	92	Drive pipe	95	Drive pipe
2128	Bottom of Little Lime		Showing of oil at 2225 ft. Very little gas. Shot well with 40 qts. nitro- glycerine in Clinton sand. Oil shot over derrick. Much gas. Rock pres- sure 900 lb.	885	Top of Lime	895	Top of Lime
2160	Top of Clinton			1178	Big water	1173	Big water
2165	Gas			2070	Bottom of Lime	1920	Showing of oil
					No sand	2070	Bottom of Lime
				2173	Shell	2156	Top of Clinton sand
				2224	Bottom of hole		(Gas, 500,000 ft.)
						2166	Bottom of Clinton sand
	Well No. 3.		Well No. 4.			2206	Bottom of hole
98	Drive pipe	83	Drive pipe				
240	Shale gas	870	Big Lime				
900	Shallow gas (abundant)	1485	First water				
		1501	Salt, 15 inches				

When folding has occurred in Ohio, it has been gentle ; the dips are slight, and not much



Fig. 3. LOWER SILURIAN SEA.

920	Big Lime	1830	Oil showing
1156	First water	1640	Salt, 4 feet
1185	Big water	1875	Second water
2080	Bottom of Lime	2019	Hole full of water
2197	A little sand	2047	Bottom of Lime
2299	Bottom of hole	2068	Shell
	No more sand	2390	Bottom of hole
			Red Rock 50 ft. or more at bottom of hole.

faulting has taken place. Dr. Orton, formerly State Geologist of Ohio, states that in southern and eastern Ohio the early structural features have a northeasterly trend. He also points out that the Cincinnati arch, a very low anticline, has this direction, marking the earliest folds of the Appalachian system, going but

back for its date to the Ordovician period; and, further, that the low anticlines of south-east Ohio belong to the same system as those of western Pennsylvania, and all of them are referable to that great series of movements to which the eastern border of the continent is due.

That the Clinton formation in the region under discussion is but little folded is seen from the well records. These show that there

used in locating future wells, and since the sand is patchy and is not continuous throughout the field, the writer advances the following theory for the accumulation of oil and gas in the Pittsfield area. Once the manner of formation of the oil and gas reservoirs is understood, the method of locating future wells becomes clear.

The shaded areas on Fig. 3 show the position of the Ohio-Clinton seas during the Lower

ELEVATION OF WELLS, INCLUDING DEPTH, THICKNESS, AND ELEVATION OF THE PRODUCING CLINTON SAND, AND OF TRACES OF CLINTON SAND.

Number.	Elevation above sea-level in feet.	Depth to top of Clinton sand from the surface in feet.	Thickness of sand.	Elevation of sand in feet below sea-level.	Yield of well in cubic feet of gas.
1	750	2160	Did not drill through the sand	1410	3,000,000
2	770	2202	28 ft. broken sand	1432	350,000 ft. gas. 5 bbl. oil per day
3	780	2197	2 ft. sand in small amount, mixed with shale	1417	Dry
4	750	No sand	No sand	No sand	Dry
5	740	No sand	No sand	No sand	Dry
6	760	2156	8 to 10 ft. broken sand	1396	500,000
7	770	2193	Broken sand	1423	1,250,000 ft. gas 2 to 3 bbl. oil per day
8	780	No sand	No sand	No sand	Dry
9	780	2188	2 ft. sand in small amount, mixed with shale	1408	Dry
10	800	2131 18 ft. shale 2159	10 ft. sand 18 ft. shale 4 ft. sand	1331 18 ft. shale 1359	1,250,000
11	780	2205	9 ft.	1425	3,250,000
12	790	2120	Trace of broken sand	1330	Dry
13	740	2163	10 ft.	1423	1,500,000
14	780	2182	10 ft.	1402	5,000,000
15	800	2155	1 ft.	1355	Dry
16	780	2172	12 ft.	1392	6,000,000 ft. gas
17	770	2197	15 ft. broken sand	1427	Oil and gas Well being cleaned
18	790	2169	25 ft. broken sand	1379	2,000,000 ft. gas
19	780	No sand	Dry	No sand	Dry
20	790	Little broken sand	Dry	A little broken sand	Dry
21	790	No sand	Dry	No sand	Dry
22	770	2160	3 to 4 ft. sand	1390	500,000 ft. gas
23	770	Trace of sand	Dry	Trace of sand	Dry
24	780	No sand	Dry	No sand	Dry
25	790	No sand	Dry	No sand	Dry

is no particular relation between the anticlines and the oil and gas accumulations. They also show, and that strikingly, that wherever sand was encountered in any considerable amount, no matter whether the sand was broken or in a solid homogeneous bed, there gas has accumulated; and in some places, oil. The wells that were dry either did not strike any sand at all or else found only from a few inches to a foot or two of sand much intermixed with shale, the proportion of sand being so small that it was barely noticeable.

Now, since the anticlinal theory cannot be

Silurian period. It was in these seas that the Clinton formation was laid down.

The heavy line at A represents the direction that the long axis of an off-shore sand deposit would take. This direction is northwest and southeast. In Fig. 2 (see also Fig. 4), wells 1, 6, 14, 11, which struck the gas-sand, are in a general northwest-southeast line, and are bounded on nearly all sides by dry wells, which found no sand or only a trace of sand mixed with shale. This is what we would expect in an off-shore deposit. Shifting currents of water would intermix the sand and mud, giving



Fig. 4.

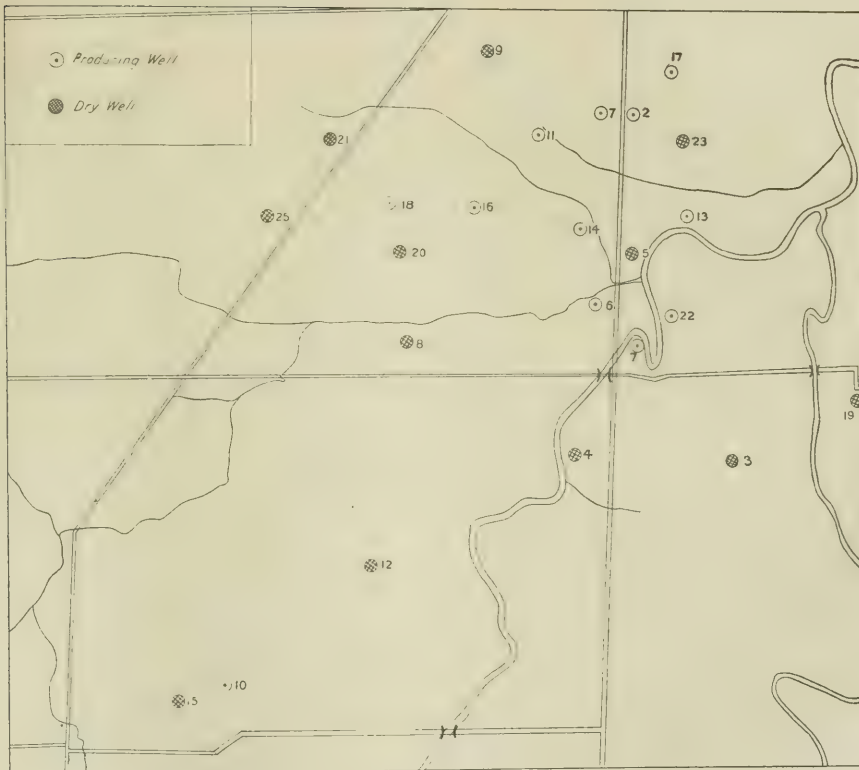


Fig. 2. DISTRIBUTION OF WELLS.

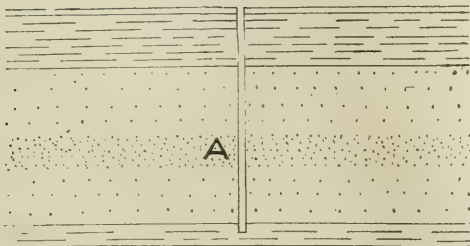


Fig. 7.

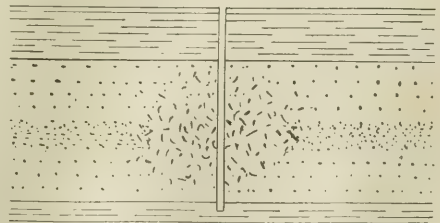


Fig. 8

the mixed sand and shale found in a number of the wells; likewise the two sands with the interbedded shale, found in well No. 10. Stronger and more uniform currents would give the solid homogeneous sands. The gas-sand is light-coloured, rather fine grained, and rounded, evidently by water. These sand deposits of the northern extremity of the Ohio-Clinton seas, where the seas extended into Ohio, and the oil and gas sands of the Pittsfield area, are one and the same.

In other parts of Ohio, these off-shore sand-bars would have their long axis striking in various directions differing from that of the Pittsfield district, for the shores of the ancient Ohio-Clinton seas curve in other directions than those which they followed in the Pittsfield area.

In locating wells it is necessary to follow the buried shore-lines of the Ohio-Clinton seas, for along these shores the deposits now holding the oil and gas were laid down. Once a sand-bar has been located, the direction of the Ohio-Clinton shore-line for that locality must be ascertained, and as the off-shore deposits would run approximately parallel to the shore, the position for future wells can be determined. Anticlinal folds may enter into the problem, making its solution more complex, but in Ohio the folds will be gentle.

Production.—Three wells so far have yielded oil (Fig. 2, wells 2, 7, 17, and Fig. 5), but only in small quantity. Well No. 2 gives 5 barrels of oil per day; Well No. 7 two or three barrels per day; while Well No. 17 is at present being cleaned out and the yield has not been determined. The oil is of a dark-green colour.

The search for gas, however, was the motive to which the development of this field is due. The yields of the various wells are set forth in the preceding table. Well No. 16 is the largest producer, yielding 6,000,000 cubic feet of gas. The rock pressure in the wells averaged 900 lb. per square inch.

Shooting the wells with nitroglycerine has doubled the yield in every case in which it has been tried. For example, in Well No. 2 the record shows that at 2280 ft. drilling was stopped. There had been a showing of oil, and a little gas. The Clinton sand was struck at 2202 ft., and the bottom of the sand reached at 2230 ft. Then 40 quarts of nitroglycerine were blasted in this Clinton sand, with the result that oil gushed over the derrick, and a flow of 350,000 cu. ft. of gas, with a rock pressure of 900 lb., was secured. The well now also yields 5 bbl. of oil per day.

The reason for the increase in flow of oil or gas from a well through the explosion of nitroglycerine at points in the well where the sandstone seems most likely to produce a good yield of oil or gas, is summed up by M. L. Fuller in the 22nd Annual Report, Part III., of the United States Geological Survey, as follows: When a well penetrates a fine-grained sandstone, the oil ordinarily enters the hole rather slowly. This is on account of the fineness of the rock texture, and because of the small surface exposed in the walls of the well from which the oil can enter. It is evident that anything which will increase the size of the surface from which oil can enter the well, or which tends to open the pores of the rock, thereby increasing the ease with which the oil passes through the rock, will tend to produce an increased flow. Both of these results are obtained by shooting the well with a charge of nitroglycerine. The effect of the explosion is to shatter the rock completely for a radius of several feet, and to loosen the sandstone and open its pores for a considerably greater distance. The well is, of course, more or less clogged by the operation, but is usually cleared out with a drill without difficulty.

The manner in which the increase in production of oil and gas comes about as the result of shooting the well, may be more clearly understood by referring to Fig. 7 and 8. Mr. Fuller has set forth the following example. Fig. 7 represents a well penetrating an oil-sand lying between two shales, and assumed to be oil-bearing throughout, but with a maximum flow in the coarser layer at A. All oil entering the well must work its way slowly through the rock, passing into the well through the walls of the well. If the sandstone is 10 ft. thick, and the hole of the well 6 inches in diameter, there will be 16 sq. ft. of surface through which the oil can enter. Fig. 8 represents the conditions after the explosion of a small charge of nitroglycerine at A, on the moderate assumption that the rock within a radius of $2\frac{1}{2}$ ft. from this point has been shattered, and that the sand has been loosened everywhere within a radius of 5 ft. The shattered portion of the rock will offer practically no resistance to the entrance of oil into the well, the actual surface from which it now enters being the surface enclosing the shattered portion. This, in the case assumed, would be approximately spherical in form, and would have an area of about 79 sq. ft., or some five times that of the original surface of the walls of the well. The entrance of the petroleum would be further facilitated to a considerable

extent by the opening of the pores, due to the loosening of the component grains of the sandstone by the shock of the explosion.

Whether the total life-production of a well is increased by shooting depends upon local conditions. If a pool is small enough, so that all parts come within the influence of the wells under ordinary conditions, the total supply will not be increased. If, on the other hand, the oil formation is extensive, there will be a probable limit beyond which the pressure of

known as the Pittsfield Gas Company. Mr Hall was made president and general manager. It is he who has kindly supplied the following records used in this article: depth to the top of the Clinton sand from the surface, thickness of the Clinton sand, yield of wells, rock pressure, and amount of nitroglycerine used in shooting the various wells.

The object of the company was to secure a sufficient supply of natural gas to supply the town of Oberlin. On August 10, 1911, drill-



Fig. 6. WELL No. 13, BLOWING GAS.

the oil's associated gas, or the weight of the oil itself, will be insufficient to cause it to flow toward the well in opposition to the ordinary atmospheric pressure; for the entrance of oil into a well always is opposed by an atmospheric pressure of approximately 15 lb. per square inch. In shooting the well, the total production of the well is probably increased only to the extent that the sphere of influence of the well is enlarged by the shattering and loosening of the rock by the explosion of the nitroglycerine.

Development. — During October 1911, Mr. Fred Hall, of Oberlin, organized what is

ing was begun. Success attended the venture, Well No. 1 yielding 3,000,000 cu. ft. of gas, with a rock pressure of 900 lb. The site of the following wells and the success attendant can be seen from Fig. 2, and the preceding tables of production. Although a number of the wells proved dry, well after well was put down, until at the present time not only the town of Oberlin is supplied with natural gas, but a pipe-line recently has been completed to furnish the power-plant of the Cleveland Southwestern Traction Company, at Elyria, Ohio, with 2,000,000 cubic feet of gas per day.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

The Imperial College.

The Editor:

Sir—The arguments used in the Report of the Royal Commission on University Education in London are all based on the fallacious assumption that an organization constructed in imitation of that which has grown up in our older universities is an essential instrument in education. The ordinary university plant, composed of committees, delegacies, faculties, senates, convocations, and courts, is merely due to the inheritance of disadvantageous vested interests, which are now too much interwoven to permit of disentanglement by the ablest single administrator. The constitution of every one of our old universities is not, as seems to be commonly supposed, the ingenious design of intellectually able men, but is merely the legacy of a gouty past. The machinery of the university bears to that of a modern, large, self-contained college a relation similar to that between the most perfect form of reciprocating engine and the steam turbine. To tie the Imperial College of Science to the London University would but add more wheels to a machine already rendered notoriously inefficient by the internal friction of too much gearing.

The Imperial College is now able:

(a) to cover subjects sufficiently varied to provide a broad education; to maintain a high-class staff large enough to control and moderate individual eccentricities, as well as to ensure stability and continuity of policy; and

(b) to maintain among its 800–900 students such necessary accessories to class education as the usual intellectual societies, athletic clubs, and even a contingent of the Officers' Training Corps.

The real danger, indeed, of the Imperial College is its large size; any increase in its list of subjects will but add to the difficulties of administration, with a corresponding reduction in mechanical efficiency. A well recognized fundamental principle of administration requires the splitting off, for self-government, natural self-contained units whenever these reach the size necessary, and include interests sufficiently varied to ensure stability. But the proposal of the Royal Commission is utterly opposed to the natural direction of evolution;

it is a symptom of mental conservatism that no evidence could ever influence, and this Report might well have been written without troubling witnesses at all. The whole idea reminds me of the chauffeur, who, having discovered the beautiful principle of ball-bearings, tried to reduce friction all-round by putting a handful of balls into the differential gear-box. It is difficult to believe that any experienced administrator could fail to realize that the proposal of the Commission is but to introduce confusion, where an orderly classification of educational activities is possible: it is equivalent to running express trains and goods traffic on the same pair of lines.

THOMAS H. HOLLAND.

Alderley Edge, October 18.

Mine Managers as Valuers.

The Editor:

Sir—I have read in your issue of August the article on 'Mine Managers as Valuers' by Mr. Morton Webber, and the various letters that have since appeared on the subject. As I do not speak from the view-point of the valuer or the mine-manager, but from a knowledge of the mining industry gained in administration and finance, my observations may be of interest.

There exists a good parallel to Mr. Webber's plea for "greater specialization in the art of mining." The mine-manager who is competent to undertake the work of the valuer would consider of little weight the opinion of a bone specialist on what was the matter with his throat, yet both are equally qualified practitioners. This brings before me the observation of another critic that "the general practitioner if he is honest and knows his business will call in the specialist indicated as particularly qualified to solve the problem." By "general practitioner" is meant an "all-round" engineer, whoever he may be, now that the industry of mining covers so wide a field.

I think this argument unsound, inasmuch as most important mining operations are now under the supervision of directorates, which should exhibit competency by employing the right man. When they are not sufficiently skilled in their business to employ the particular specialist required, it is difficult to see

their usefulness. Returning, however, we must note the qualification "if he knows his business." Here we come to the point. The mining regions of the globe furnish many examples where the "all-round" engineer has held on too long, thereby losing his employer's money, either through mismanagement, or on a worthless proposition; not because he is dishonest, but because he does not understand the particular property he is attempting to manage. The mining industry is not often menaced by the dishonest engineer but by the engineer who undertakes work that he is unable to perform. I note that Mr. Webber advocates that the mine valuer "should have special aptitude in laying out a development scheme that will permit the cutting of a loss with a minimum expenditure of time and money; and concurrently give the property a fair trial." This, I think, comprises a prime function of the valuing engineer.

Mr. Webber described actual examples of gold mines of great dissimilarity wherein the experience in the managing of one mine would be of little value in assisting the manager to value either of the others. It seems to me that definite facts such as these are of incalculably more value than any amount of theorizing to the contrary. I am tempted to add that the experience of the engineer during the time that these examples were collated must also have afforded examples of the type of mismanagement to which I refer. Too often has the "general practitioner" delayed requisitioning the services of the specialist until the latter could only perform an autopsy.

I agree with Mr. Webber that the B value, or future possibilities of a property, is of the greatest importance. Something more is needed nowadays than merely a statement of existing conditions, and the presentation of a mine's future as a possible percentage of value to be added to the existing assets as represented by standing ore. In considering the financing of mining enterprises it is decidedly important that a valuing engineer, whenever possible, should state clearly in his report what size of undertaking he considers the enterprise likely to develop into. In fact, an engineer should bear in mind that his client is primarily interested in the future possibilities of the property. Broadly speaking, there is little money to be made in the purchase of ore reserves. Such a transaction usually resolves itself into a problem of discounting. If it is proposed to consume a certain ore reserve in, say, five years, one-fifth of the operating profit will represent a discount note for one year, and so

on, up to the last fifth, which represents a discount note for six years. That there is no speculative attraction in this is obvious. The purchaser really buys the known ore reserve to get title to the mine's future.

In flotations that require public funds we must recognize that speculative possibilities of enlargement and increased dividends are demanded by the investor. That this is a fundamental truism I believe will be granted by those who have occasion to seriously consider the various branches of mining finance. A valuing engineer when reporting upon a mine should incorporate in his report a definite opinion on the continuance of the mine after the consumption of the present ore reserves, the possibilities of general enlargement, the possibilities of adjacent area, or conversely, *if the present ore reserve will probably represent the total or major portion of the fruitful career of the enterprise.*

I think it is evident that the mine valuer whose speciality should be the general consideration of ore deposits is the better fitted to meet this necessity.

E. P. EARLE.

New York, October 10.

The Future of the Rand.

The Editor:

Sir—In your July issue there appears an interesting report on 'The Future of the Rand,' by Mr. G. A. Troye, whose intimate association with South African mining has been of exceptional duration and who is thus peculiarly well qualified to discuss the present conditions and future prospects of the industry. Editorially, you remark that Mr. Troye is an "independent engineer," "not identified with any of the financial groups," suggesting that his valuations thus have peculiar significance. As this personal element has been introduced, it may be emphasized that Mr. Troye would also, in consequence of this independence, be seriously handicapped in his task. Only the few engineers closely identified with the groups can possess the detailed information of the distribution of ore-reserves and assay-values to enable them to attempt refined valuations on a technically sound basis. The rough-and-ready manner in which the Robinson mine is valued, although its development is practically completed and its declining profits a matter for comparatively close estimation, may be mentioned to instance the difficulties of valuation (on a technical basis rather than from a study of market conditions), without all available knowledge of the facts.

On the broader question of the Rand's life, Mr. Troye's summarized forecast is not particularly cheerful. Perhaps with greater wisdom than some other students of this question have displayed, Mr. Troye carries us only to 1940 (with "about a dozen companies then in evidence") and says that "it is to be feared the end will then be in sight." This statement is at least fortunately indefinite. The end may be then in sight, just as conditions in 1940 are "in sight" to Mr. Troye today. It may be more aptly considered a new horizon.

A debate along these lines is generally as indefinite in its termination as the Rand; certainly less profitable. However, conscientious estimates as to the final collapse of the industry generally have in common an absence of any unfavourable bearing on the market valuation of individual companies, as discussed by Mr. Troye. The probabilities entering into the problem have, nevertheless, a weighty influence on the future of the Transvaal and on the world's supply of gold. On this account, it is a matter for regret that the engineer best qualified to publicly discuss the goldfield's probabilities, has been unwilling or unable, for official reasons, to give the world the benefit of his speculations on the subject. I refer to Mr. R. N. Kotze, Commissioner of Mines, whose information and whose ability to interpret all known conditions, are unequalled. If Mr. Kotze would sum up the evidence and give his verdict on the Rand's life expectations, there would be no call for any presentation of the confidential data upon which his conclusions were based.

It is surprising that Mr. Troye, seeking to find comfort for the effects of a depressing forecast, should point to nickel as one of the principal hopes for the country's mining stability. He remarks: "Of nickel, little is generally known here, but prospecting is now in progress on a deposit that looks quite as promising as Sudbury." Until recently, at least, the Insizwa nickel occurrence (Griqualand East) was the most noteworthy nickel deposit in South Africa. Although a promising prospect, and productive of microscope rock-slides bearing close resemblance to sections from Sudbury, a comparison could hardly be made on a basis of 'mine size' lots. Would Mr. Troye amplify his comparison in any reply to this discussion, so that Canada may look to her laurels?

Whatever the possibilities of the base metals in South Africa, the prospect of their successful development can do little to brighten the present outlook for Rand shareholders. The

necessity for such assistance to keep Transvaal mining on its feet is urged in your editorial article even more strongly than by Mr. Troye, when you state that "the decline (of productive activity on the Rand, measured by dividends) will be slow at first, but accelerated after another decade. But that does not mean the end of the mining industry in the Transvaal, for base metals will be produced in larger quantities than today from mines tributary to Johannesburg."

This hope of salvation from outside does not, I fear, carry enough assurance, at present, to balance the stated certainty of the rapid collapse of the gold industry. The fall in the Rand's grade with increasing depth is commonly represented as an all-important and fatally dominating factor (*The Mining Magazine* being a consistent exponent of this broadly accepted doctrine). But other circumstances, liable to result in a continuance of "productive activity" for many decades beyond the observed horizon, are as commonly ignored.

Assume the worst: that base metals fail to play the part desired and that gold must continue to be the mainstay of national life. When we approach the "end of the Rand," revolutionary changes of economic condition will be experienced, involving new factors favourable to cheap operation. The country will be fully equipped for cheaper production. Full benefit can be obtained from the expenditures on railways, power-plants, irrigation schemes, and all other items of industrial equipment incurred during the term of big revenues preceding the period of apparent doom. There will be many thousands of highly skilled white miners, British and Dutch South Africans, settled in the country and urgently in need of local employment. Advantage will be obtained from the greatly reduced cost of living, inseparable from the influence of established production, of declining markets, and diminished property values. The Government will be forced to restrict public expenditures to an absolute minimum and to relieve the mines of their great burden of direct and indirect taxation. Yet the most significant factor, without parallel in the history of any mining district in the world, will be the influence of several hundreds of thousands of experienced natives, certainly over half a million between the ages of 18 and 40, highly efficient in the unskilled and semi-skilled branches of mining and unable to migrate to other lands, for whom intermittent employment will become a matter of necessity.

Upon approaching the limits of profitable mining set by present standards of payability in relation to depth or grade of ore, these compensating factors, making for low operating costs now hopelessly unattainable, will automatically appear. A reduction of 4 or 5 shillings per ton in working expenses would be readily attained, without any assumption of improved technical methods.

This hope of continued vitality, through the influence of self-regulating economic changes, may provide more satisfaction to the inhabitant of the Transvaal than to the European investor in Rand mines; but it may still appear of more immediate encouragement to both, than the prospects of copper in Tanganyika, of tin in Swaziland, or nickel in Griqualand East.

RALPH STOKES.

Juneau, Alaska, October 5.

Travelling in Russia.

The Editor:

Sir—In your October issue Mr. J. P. Hutchins in his article makes some adverse criticisms of the Wagon Lits Company's trains on the Trans-Siberian railway, which I consider to be rather unfair, after having spent over three weeks on their train during the current year.

I found their *table-d'hôte* meals were well cooked and well served. An *à la carte* meal was always obtainable between the hours of 7 a.m. and 10.30 p.m., except while the *table-d'hôte* meals were being served. The prices were extremely reasonable and the attendants at all times sober, attentive, and capable.

I should advise anyone not having some knowledge of Russian to travel by these trains, although the fares charged are somewhat higher than on the State expresses. The journey to the East through Siberia is extremely interesting and comfortable, even in winter.

STANLEY H. DE LA MARE.

London, October 23.

Falcon.

The Editor:

Sir—Will you kindly give publicity to the following:

I have recently returned from a five weeks trip into Northern Rhodesia, during most of which time I have been entirely out of communication. I find on my arrival here the various published statements emanating from the Falcon company and others. I have accordingly requested the board of the British South Africa Co.'s Mines Development Co. to

grant me permission to make this public statement with the distinct understanding that I do so solely on my own responsibility, accepting all liability therefor, and that it can in no way be considered as expressing their views and opinions. Furthermore I have no authority for writing on behalf of Mr. Ackermann, and this letter cannot be considered as expressing his views or involving him in any way.

Lord Harris, in his speech delivered at the Gold Fields meeting on July 15, referred to the conditions under which I became connected with these examinations. The Falcon company has likewise published assay results, and I am therefore committing no breach of confidence in reviewing the situation and supplying the figures which will follow. Briefly stated, it was proposed in London to form a syndicate, in which the British South Africa Co.'s Mines Development Co. was offered participation for the purpose of acquiring an option on the shares of various Rhodesian mining companies. Amongst these figured the Falcon. It was stipulated by the British South Africa Co.'s Mines Development Co. that their engineer should have the right of examination and sampling, subject to the proviso that a copy of their engineer's reports be supplied to the companies whose mines he examined. Mr. McDonald has criticized the amount of time given to the work in hand. I give prominence to these facts in order that it may be understood that my reports only extended over such period as I considered sufficient for the purpose for which they were intended. I was merely asked by the British South Africa Co.'s Mines Development Co. to advise them as to the desirability of making the investment referred to, and having obtained what I considered to be sufficient information for that purpose, there was no object in going into greater detail, or incurring further expenditure. The amount of time and money warranted in the examination of any enterprise is naturally contingent upon the purpose for which the work is undertaken.

Mr. McDonald in his cable of July 15—published in the Falcon Co.'s circular of July 16—makes free use of the assay results given in my report as determined by a Bulawayo assayer, and states that he could never accept our sampling with confidence owing to the hasty manner in which it was carried out. The assays of the samples taken in the Falcon mine were made by a prominent public assayer in Bulawayo, who had for a considerable period done a large proportion of the

work for the Rhodesia Exploration & Development Co. and other prominent Rhodesian concerns, and I therefore at that time believed his work to be accurate.

Upon receipt of my report Mr. McDonald challenged this assayer's work, in response to which I pointed out that in my report it was stated that the values given therein were contingent upon verification by some competent London assayer. Portions of the same samples were accordingly sent to England for determination there. Shortly after my report was despatched the Bulawayo assayer admitted an average error in his copper determinations of 0.34%, and the subsequent assay of these samples in London by two competent firms confirms this error, and places the gold at an average of 1.5 dwt. higher than that obtained in Bulawayo.

The doubts cast by Mr. McDonald on the work of our sampler are unwarranted and without foundation, and I cannot allow them to pass unchallenged. I shall show later that the assays of our samples as determined in London check closely with the independent sampling of the Falcon mine referred to in Mr. McDonald's cable of July 15; and that both these results are very considerably below those shown on the mine assay-plan as submitted to us.

Coming now to the Falcon company's official circular dated July 16, it is stated, *inter alia*, that they sent "two trained and independent men, whose thoroughness and care cannot be questioned, to sample exactly over the cuts made by Messrs. Ackermann and Pickering's samplers." The tabulated statement prepared in London and appearing at the end of the circular conveys the idea that the result of this independent work offers, by comparison, an almost complete vindication of the company's assay-plan. I shall now show that this comparison is entirely wrong.

Mr. McDonald states in his cable that the assay-results of the samples taken by the two independent men are calculated on the basis of Mr. Ackermann's price for copper and gold, that is to say, 11.6 shillings per unit for copper, and 4.24 shillings per dwt. for gold. The Falcon circular, however, in comparing the results obtained by the independent men with the values shown on the mine assay-plan, has, with regard to the latter, used Mr. Piper's price of 10 shillings per unit for copper and 4 shillings per dwt. for gold.

If the correct figures are introduced it will be seen that the average results of the two independent men over 8 cross-cuts aggregating

560 ft. in length are 14.3 shillings per ton lower than those shown on the mine assay-plan, and not 4s. 10d. as shown in the circular.

The correct comparison follows. In this I give, in separate columns, the values shown on the mine assay-plan, those obtained by the independent men, and my values as determined in London, all calculated on Mr. Ackermann's price for copper and gold and expressed in shillings per ton of 2000 pounds.

	Width	Value shown on original mine-plan.	Value obtained from independent re-sampling.	Value of my samples as determined in London.
<i>4th Level</i>				
No. 4 cross-cut east...	85	97.2	72.6	71.3
No. 6 cross-cut east...	80	60.6	45.0	41.1
<i>5th Level</i>				
No. 9 Shaft cross-cut	85	82.4	64.0	74.3
No. 1 cross-cut east...	90	74.8	74.3	71.0
No. 2 cross-cut east...	70	72.2	69.0	60.8
<i>6th Level</i>				
No. 1 cross-cut east...	90	68.4	49.8	53.3
No. 2 cross-cut east...	45	92.9	73.0	60.6
No. 1 cross-cut west	15	54.1	38.7	41.6
	560	76.9	62.6	61.5

It should be noted that the figures set forth in the last column represent one side of each cross-cut only, the other side being sampled by Mr. Ackermann's engineer. These latter furnish a further check.

J. C. PICKERING.

Bulawayo, August 29.

The Editor:

Sir—I have had the advantage of perusing Mr. J. C. Pickering's letter of August 29 and after obtaining permission from the board of the British South Africa Company to make this public statement, I wish to state that I am in entire agreement with everything Mr. Pickering has to say therein and the figures that he has presented.

In Mr. Pickering's comparative statement of assay-values for the various cross-cuts sampled by us during our examinations of the mine, he has given the results of his samples determined by London assayers to average 61.5 shillings. My samples assayed in London were found to average 62.3s. From which it will be seen that we agree very closely with the average obtained by independent sampling, namely, 62.6s., all calculations being based on copper at £65 per long ton and gold 4.24 shillings per pennyweight.

A. H. ACKERMANN.

London, October 24.

Ore.

The Editor :

Sir—In connection with the question recently discussed in your publication concerning the terms so frequently employed in mining reports descriptive of ore estimates, namely, 'positive,' 'probable,' and 'possible,' 'profitable' and 'unprofitable'; the question is immediately raised: "What is the present-day definition of an ore?" For example, are the non-metallic products, coal, baryta, and phosphate, included under this designation? In the usual modern acceptance of the term 'ore,' coal is not; baryta is doubtfully so; and phosphate is more often considered such than otherwise. My own view is that logically all should be included under the term.

May I venture a definition? An ore is any natural product, derived from the earth, either as an element, a chemical compound, or a mixture of compounds, which carries within itself some latent property enabling it to add materially to the world's wealth for use in the arts, manufactures, or agriculture, if, previously, it has undergone some kind of treatment, whereby it is entirely changed chemically or physically, or whereby such substances as are deleterious to its usefulness before application are removed.

As coke is made from coal, evidently coal, under my definition may be considered an 'ore.' Phosphate and limestone for the manufacture of lime, which have to undergo both chemical and physical changes before being utilized, are even more obviously such. Building stone, however, would not be so classified, as it undergoes no change before being employed.

I maintain that in the definition of 'ore,' the metallic or non-metallic nature of the material to be derived from the raw product, or the amount of its commercial value at the moment, have no place in its consideration—statements which bring me to a discussion of 'ore estimates.'

'Ore' remains ore, whether it is 'profitable' or not, and reserves should be estimated on a basis of 'profitable' as well as 'unprofitable' tonnages. What is unprofitable to mine today may, through some improvement in metallurgical practice or for some other reason, become so tomorrow. No one can say, for instance, when a gangue containing only a very small percentage of copper, valueless in itself, may not become valuable as a flux by increasing the value of the product which is being smelted, or when a very ashy coal may not, within limitations, be utilized

for its gas and its oil.

The terms 'positive,' 'probable' and 'possible,' are, I maintain, useful as summary headings, under which each variety of ore may be classified.

Thus, under 'positive' ore may be placed :

(a) All ore measurable on 4 sides.

(b) " " " 3 " "

Under 'probable' ore may be placed :

All ore measurable on 2 sides and under 'possible' ore.

All ore reasonably inferable with only one side visible.

In exceptional cases, a fourth class, 'prospectively possible,' might even be added, to include such hypothetical bodies as may be expected to exist at any level from deduction, as to the behaviour of the shoots at levels above, or where the continuity of the orebody beyond the boundaries of development is known either by bore-holes or cross-cuts. If even rough estimates of this nature can be obtained, information is available, which certainly adds evidence of some value as to the possibilities of the property under examination.

E. T. MCCARTHY.

London, October 30.

[We take pleasure in publishing this letter from Mr. McCarthy. The definition of technological terms is the first requisite to the intelligent use of them. We invite further correspondence on the subject.—EDITOR.]

Copper and Bananas.

The Editor :

Sir—I shall be glad if you will assist me from your store of information and experience to a proper understanding of a mining appointment which is at present perplexing me and many others here.

The Fiji Copper Company, Limited, of London, recently registered in this Colony to develop a certain mining concession on which exists a valuable dike formation of bornite, has appointed as its managing director in Fiji a local banana-buyer. The appointee came to this colony from Mauritius as a youngster close on thirty years ago, since when he has never been out of the Colony, has never seen a mine in his life, and whose experience of mining and mining-company business is *nil*. As one entitled to some 15,000 shares in the company under an order of the Supreme Court of Fiji, I should be glad if you will kindly let me know how an experience of bananas and sugar cane qualifies a man for the managing

directorship of a copper-mining company.

J. CRANSTON.

Fiji, September 27.

[Mr. Cranston enclosed a postal order for 4 shillings for three copies of the Magazine in case we were able to supply him with the information required. We are unable to see how experience in the banana trade qualifies anybody for the management of a copper company, but we believe that it affords at least as good a preparatory training as the command of a regiment, the possession of a peerage, excellence in the law, or unusual skill in cricket. As we have been unable to explain the relation existing between bananas and copper, we are returning the 4 shillings to Mr. Cranston.—EDITOR.]

Esperanza.

The Editor:

Sir—The analysis which I sent you was based entirely on the facts as set forth in the published reports of the Esperanza Co., and it was our misfortune that you did not give it better attention. The Mexico shareholders are very greatly disappointed with your treatment of the matter in the August number of *The Mining Magazine*, for we had, and still have, an abiding faith in your sense of fair play.

Now that you have come out in support of the Esperanza management, it is, probably, not worth while commenting further on Esperanza with the expectation of having it made public, by you. However, I feel so sure that you have been misinformed that I am taking another chance with the hope that you

able blocks which should yield a net profit of \$320,600. This is equivalent to \$3.195 net per ton."

On page 22 the following statement appears, under the title 'Future Possibilities':

"The year 1912 witnessed the practical exhaustion of the known ore reserves in the older parts of the mine."

A comparison of these two statements leads to the conclusion that the estimated reserve of 100,334 tons includes all of the ore that is developed, partially developed, and probable in the whole mine, including the San Carlos orebodies.

On page 21, under the title 'Development,' this statement occurs:

"The only ore developed was in the San Carlos vein, which now shows an orebody 1100 ft. long on the 11th level with a vertical depth of 300 ft. from the 9th to the 12th level."

The regular monthly report, published by the company, gives a condensed statement of the progress of the San Carlos development, showing the number of feet advanced in the drifts, rises, and winzes, together with the averages of the widths and assays of the ore passed through by these openings each month. Compiling these distances, widths, and assays, and reducing them to geometrical averages, shows that the average width of the ore passed through (including the 1911 reports) was 3891 ft. and the average assay-values were 1.56 oz. gold and 3 oz. silver per metric ton (the silver is calculated as the assays are not regularly given). Assuming that the published reports are correct then this San Carlos orebody, alone, from the 9th to the 12th level, shows the following tonnage and value:

335.36 by 91.46 by 1.186 metres by 2.7 (tons per cu. m.) = 98,218 dry metric tons.

1.56 oz. gold per dry metric ton at \$20.67 = \$32.24

3.00 oz. silver at 0.59 = 1.77

Total assay-value.....\$34.01 at 85% saving = \$28.90

Costs, estimated from the 1913 reports 8.62

Net value per ton \$20.28

98,218 tons at \$20.28 = \$1,991,868.

will give your unbiassed consideration to the following statements of fact, and, if you are convinced, that you will give the matter due publicity.

On page 21 of the Annual Report for 1912 the consulting engineer makes the following statement, under the title of 'Ore Reserves':

"On December 31st, 1912, the mine showed 100,334 dry metric tons of ore in reserve. These reserves include developed, partially developed, and prob-

The above result is based entirely on the published reports of the company. Where does the consulting engineer get his estimate of \$320,600 as the total value of the ore reserves? He cannot possibly have estimated the only block he locates at such a low figure—not consistently.

From the published data it is permissible to assume that his estimated reserve of 100,334 tons applies only to the older parts of the mine,

and the following apparently confirms this assumption :

metric ton. In support of my statement the following tabulation of the monthly reports is

Estimated reserve December 31, 1911, 200,443 tons, at \$3'187 net per ton

„ „ December 31, 1912, 100,334 „ at \$3'195 „ „

Ore taken from old reserves in 1912, 100,109 tons

This is further confirmed by the 1912 milling report, assuming that about 20% of the ore produced, during 1912, came from the San Carlos vein.

Also the value per ton given to this ore confirms the supposition that it is located in the older parts of the mine, and that no estimate of the San Carlos orebody was included in the report for 1912.

What answer can the directorate and the consulting engineer make to this analysis of their published statements? It seems clear that either the estimates of the ore reserves made by Mr. Titcomb are wrong, or the published assays of the San Carlos ore are false. Which is it?

Another matter : Why are all the published statements of the management so pessimistic? Isn't a statement of fact sufficient without advancing an opinion which, in the face of positive evidence, has no value. The management is always guessing that the andesite is or will be unfavourable, etc., etc. Is the *fact* that the adjoining mine has the same San Carlos vein, with good width and assay-values, 300 ft. deeper than the Esperanza 13th level of no value as evidence of the downward continuation of the San Carlos orebody? As this knowledge is public property it must be known to the Esperanza management.

A compilation of the monthly reports from January to July, 1913, is in contradiction of your statement, that the San Carlos is a small and patchy vein, or again the company reports are false. During this period 1065 ft. of driving and 838 ft. of rising was accomplished. The ore in the drifts, month by month, is reported as having an average width of from 5 to 6'5 ft. and the assays run from 0'75 oz. up to 1'75 oz. gold per metric ton. The average widths in the rises is stated to be from 5 to 6'25 ft., and the assays from 0'75 oz. to 2'25 oz. gold per

submitted :

SAN CARLOS VEIN.

Copy of Monthly Reports from January 1 to July 1, 1913.

Month	Feet advanced Drifts	Assays Oz. gold per metric ton	Average width of ore in ft.
January	210	1'00	5'0
February	235	1'75	5'0
March	220	1'25	5'92
April	248	0'75	5'0
May	52	0'75	6'25
June	100	0'75	6'50
	Rises		
January	125	2'00	5'0
February	160	2'25	5'0
March	158	1'25	6'25
April	226	1'33	5'0
May	93	0'75	5'50
June	76	0'75	6'0

Geometrical averages are 1'259 5'39

Does the above indicate a "small and patchy" vein?

Again referring to your comments in the August *Mining Magazine* :

Without doubt there are times in the operation of a mine when it becomes necessary to break ore that will only pay its way, but there must be a limit to the amount of this loss per ton of the ore. Assuming your statement to be correct, that "for the past year about 20% of the whole tonnage has come from the San Carlos vein," then, in your opinion, is the loss shown by the following calculations justified? The figures are taken from the annual statement and from the monthly reports, as follows:

Total tons of ore milled in 1912..... 113,297

20% derived from the San Carlos vein = 22,659 tons

Produced from older parts of mine... 90,638 tons

Gross production in 1912, at a saving of 78'64%, was.....2,148,125 pesos

Cost on the total tonnage of ore milled was.....1,630,139 „

Net production from the ore was..... 517,986 „

Average exchange rate for the year was 201'22 = \$257,422.

A compilation of the monthly reports up to January 1, 1913, shows that the San Carlos ores contained the following :

the six months ending June 30 only been \$496,465, when the San Carlos ore, as shown by the reports, has an assay-value of \$27'79

Gold at 1'481 oz. per dry metric ton, at \$20'67 = \$30'61
Silver at 3'00 oz. " " " " " " " " at 0'59 = 1'77

Total assay-value per ton.....\$32'38

At 78'64% recovery (the 1912 average) = \$25'46

Cost per ton (" ") = 7'15

Net value per ton \$18'31

Result :

22,659 tons of San Carlos ore produced.....\$414,886 net
113,297 tons, the total tonnage milled, produced..... 257,422 "

Therefore, 90,368 tons of ore derived from the older parts of the mine created a LOSS of...\$157,464

A correspondingly greater loss would have been incurred in case more than 20% of the total tonnage was derived from the San Carlos vein.

It may be said that \$1'08 per ton of the above loss is a development charge, but if this non-productive ore was removed for the purposes of development, it certainly must bear its proportion of such charges. The question is, in this case, could not the same development results have been attained without the removal of more than 90,000 tons of non-productive ore. Also, if the mill-capacity had been reduced to correspond to the mine-capacity (with a corresponding reduction in power and other costs) could not the same exploration have been carried on, in the older parts of the mine, and a much larger profit made?

To carry this analysis still further: If during the current year the "bulk of the ore milled has been derived from that vein" (San Carlos) then why has the gross production for

per ton, as follows: (See detail on page 3).

Gold 1'259 oz at \$20'67 = \$26'02 per ton

Silver 3'00 oz. at 0'59 = 1'77 "

Gross value per ton.....\$27'79 at 75% saving = \$20'84

Less cost per ton = 8'62

Net value per ton\$12'22

Assuming that only 55% (the bulk) of the ore milled was derived from the San Carlos vein during this period, and that the average savings were only 75%, the following detail calculation shows the result:

If the loss per ton of \$6'94, as shown by the foregoing, is wrong, then, of necessity, the assays shown by the monthly reports are false.

I most respectfully submit that the evidence, as herein set forth, does not justify the remark, "that the company's business is being well conducted by the resident manager, by the consulting engineer and by the board."

In the operation of the property from January to July 1913 there has been a loss to the

**SUMMARY OF MONTHLY REPORTS FOR 6 MONTHS.
From January to July 1913.**

Ore	Tons milled	Gross	Total costs	Net production
33,485	Tailing	Production	inc. New York	not inc. London
	64,675	\$643,035	\$496,465	\$154,078

ANALYSIS OF COST :

Tailing cost, taken from 1912 statement at	\$3'215 per metric ton
San Carlos ore cost, taken from 1913 reports	8'61+ " "
Ore from older parts of mine " "	8'61+ " "

ANALYSIS OF PRODUCTION :

	Tons	Gross	Cost	Net	Gross
		production		production	Loss
Old ore.....	15,069	\$25,121	\$129,847		\$104,736
San Carlos	18,416	383,789	158,688	\$225,101	
Tailing.....	64,675	234,123	207,930	26,193	
Totals.....	98,160	\$643,033	\$496,465	\$251,294	
Loss incurred by milling 15,069 tons of ore from older parts of mine..... 104,736 = \$6'94 + per ton					

Net production.....	\$146,568
Receipts from rents, etc.....	7,510
Total.....	\$154,078

shareholders of about \$146,500, and for the past year a loss of about \$157,000, making a total loss for 18 months of over \$300,000. If this can be satisfactorily explained, we will be greatly indebted to the management.

If the directorate intends to accord fair treatment to the shareholders they will also publish a revised estimate of the ore reserves and values that will be in conformity with their monthly reports.

In conclusion, I beg to say that the object of the foregoing is not for the useless purpose of injurious criticism, but to call attention to the facts. The shareholders are certainly entitled to a public explanation of the glaring discrepancies which exist in the published reports of the company.

Hoping that you will consider the matter of sufficient importance to give us the benefit of your able assistance, I am, with apologies for the unavoidable length of this communication,

Mexico, September 18. J. D. HELM.

The Editor :

Sir—During the past year or more, rumours have been current to the effect that the Esperanza mine was much more valuable than the directors believed it to be; that correct information was being purposely withheld from shareholders; and that the ore-reserve estimates did not include the ore in the San Carlos vein. The origin of these rumours is becoming apparent. Three letters, dated Mexico, D.F., June 1, June 16, and September 18, 1913, and signed "J. D. Helm," have been sent to various shareholders, newspapers, and magazines in London. These three letters contain some 15 or 20 pages of criticism, and the statement: "it certainly appears that the Esperanza mine affairs are not in competent hands—at either end of the line. The inference here is that collusion exists for ulterior purposes." Mr. Helm states that his comments and analyses "were prepared without any ulterior motive whatever, and at the request of a number of Mexican shareholders (about 75,000 shares are owned in Mexico) of whom I am one."

To this I have to remark that the lists of shareholders with addresses in Mexico show that there were on June 22, 1912, eight shareholders registered on the books owning 1885 shares, and on June 16, 1913, eight shareholders owning 1965 shares. The name of J. D. Helm does not appear in either of these lists, nor on any of the Esperanza books, as a shareholder.

The space occupied by a letter to your Magazine precludes a detailed reply to the various so-called analyses made by Mr. Helm. However, several of his worst errors can be exposed. If the Editor desires further answers to Mr. Helm's other erroneous conclusions, the writer will be glad to go over with him in detail all of Mr. Helm's letters before the publication of the next issue of the Magazine. And if the Editor wishes to bring with him a committee of representative engineers and shareholders, I shall welcome their investigation of this unwarranted and unfair attack.

A dissection of a few of Mr. Helm's statements will show that his conclusions are unwarranted. The unfairness of his attack is evidenced by the fact that he did not first write to the company asking for explanations of his questions, and hear what they might have to say, but sent out for publication his *ex parte* charges of gross dishonesty. Shareholders are gladly given every information and explanation that they desire by both the directors and the consulting engineer.

Practically all of Mr. Helm's calculations are dependent on his 'estimates' of the ore-reserves remaining in the San Carlos vein on December 31, 1912. His estimate is given in the paragraph beginning "On page 21 of the annual report for 1912" and ending with "such a low figure—not consistently."

In this estimate by Mr. Helm, attention is called to the following errors:

Over-estimate of gross area:

The area of ore-reserve blocks is not found by multiplying the maximum length of ore exposed on one level by the vertical height between four levels. Mr. Helm does this, and gets an area of 30,672 square metres remaining at the close of the year 1912. If he will refer to the last annual report, pages 21, 36, 37, and 38, he will find that on December 31, 1912, the length of the ore developed on the

9th level was.....	0 metres
10th " "	45 "
11th " "	335 "
12th " "	62 "
<hr/>	
Average.....	110 "

If this average had been used the area would be 110 by 91 metres—10,010 square metres, or less than one-third the area assumed by Mr. Helm. However, both these methods are absurdly incorrect. The correct area can be obtained only by careful measurement of the blocks as outlined on a map showing the vein as the development of a warped surface.

Over-estimate of net area :

Mr. Helm makes no deductions from his gross area on account of barren spots in the vein; 400 square metres were to be deducted for such a barren spot above the 11th level stope, near rises No. 9 and 10. He makes no deduction from his gross area on account of ore already mined by development and stoping, although a glance at the map of the West veins in the last annual report would have shown him that a large tonnage of ore had been thus extracted. Up to January 1, 1913, over 25,000 dry metric tons had been so mined from this vein. With an assumed width of 1'2 metres (Helm), these 25,000 tons would represent an area mined of over 7700 square metres to be deducted from the gross area. Making no such deductions, Mr. Helm uses, in place of a correct net area, his gross area, which was already ridiculously over-estimated, as shown above.

Under-estimate of stoping width :

Mr. Helm assumes as a stoping-width the average width of samples taken in development work, which he figures as 1'2 metres (approximately). This procedure is incorrect.

I quote annual report, 1912, page 44 :

"Due to the narrowness of the San Carlos vein, a greater width must be broken in mining operations, and this low-grade material going in with the ore will reduce the grade below that determined by sampling the vein only. Assays that have been reported do not represent the grade as obtained in mining unless they are calculated to the full mining width and especially noted as such."

The reason for this is simple. The San Carlos vein occurs principally in soft black shales. The vein frequently splits into branches and stringers. Development samples do not represent the orebody as it will be mined; and instead of an average stoping-width of 1'2 metres, Mr. Helm should have taken about 2 metres.

Over-estimate of average value per ton :

Mr. Helm averages the development assays alone and applies the result, namely, 1'56 oz. per ton, to his calculations. This method is wrong in principle. It assumes that development work in the middle of an ore-shoot represents the entire area allowed, including probable ore extending beyond any development work. It takes no account of barren cross-cuts that had been run through the plane of the vein, such as cross-cut No. 12 on the 9th level; cross-cut No. 0 below the 11th level; cross-cut No. 4 below the 11th level; cross-cut No. 4 on the 12th level. Nor does it take into account other barren development

work such as the tops of rises No. 0 and 1, on the 11th level, and the north drift on the 10th level. His method entirely disregards the evidence given by such barren development work outside of the ore-reserve blocks assumed by the consulting engineer, and within the block assumed by Mr. Helm.

Again, Mr. Helm makes no corrections for erratic high assays; his estimate of assay-value per ton takes no account whatever of the stope-back samples extending over 300 metres of length; he does not reduce his sampling-width value to stoping-width value—a vital factor; nor does he take into account the actual results obtained from milling 25,000 tons of the ore. This ore is sampled both underground and automatically at the mill, and the actual results obtained from the careful sampling and milling of this tonnage cannot be neglected in calculations of ore-reserves. I suggest that Mr. Helm obtain and study a copy of 'Sampling and Estimation of Ore in a Mine,' where the effects of all such factors are explained.

The ore-reserves in a mine at any period do not represent the ultimate possibilities of the mine's future. As the development of an ore-shoot proceeds, probable ore may be converted into partly developed, or developed ore; and when so converted it is frequently right to assign a higher value per ton to the block than would have been justified when the block was still in the 'probable' class.

Other errors :

Mr. Helm guesses at the silver contents per ton, and obtains 3 oz. silver. Not a bad guess, but still it is 70% over-estimated. Again, he uses a value of \$20'67 per oz. as the price received for gold. Another over-estimate. This price was not received in 1912; and in the present year, with the Mexican export tax of 10% and a depreciated value of the peso, the value of gold per ounce in Mexico has fallen below \$19.

In Mr. Helm's letter of June 1 occurs the following statement, which is illustrative of his general ignorance (the italics are mine) :

"The ore-width factor used in calculating the above tonnage is *less than 4 ft.* although it is more than probable that the stoping width will be quite 5 ft. with the value per ton remaining the same."

Is any further comment necessary on the other estimates made by an engineer who adopts such methods in his calculations?

How the mine is being managed is clear from its record. The present manager, Mr. Charles Hoyle, took charge in 1908, when the old West vein bonanza was gone and the total

ore-reserve was worth less than £100,000 net. Since then, because of the policy of active development followed, the dividends paid have amounted to £796,250. Mr. Hoyle and his staff have remained at their posts through two Mexican revolutions; they have successfully developed the mine, and proved their worth to shareholders.

As you, Sir, stated in the August number of this Magazine, great mines die hard. The Esperanza is a great mine, and its possibilities are not yet exhausted. These possibilities are being actively and successfully developed, with the result that the mine is in a better position today than it was a year ago.

As long as the company remains under its present management, the policy will continue to be the ultimate greatest benefit for shareholders—not a 'gutting' policy for the temporary benefit of speculators.

The writer will take no notice of any further unwarranted attacks: he is too busy to conduct a correspondence school for the preliminary education of incompetent engineers in the A.B.C. of ore estimates. But any letters from *bona fide* shareholders will receive courteous attention from the company, as they always have in the past.

HAROLD ABBOT TITCOMB.

London, October 30.

[This controversy is now closed. Both sides have been heard.—EDITOR.]

Has Scotland been thoroughly prospected?

The Editor:

Sir—Your editorial note referring to Mr. Lakes' query mentions the occurrence of oil-shale in the island of Skye. While this is undoubtedly of great interest and possible economic importance, you have omitted to mention the iron-ore deposits being exploited on the adjacent island of Raasay. Among the Tertiary igneous masses of Skye there remain considerable tracts of sedimentary rocks including the Jurassic series, in which valuable iron deposits are at present being actively developed. There appears to be no reason to suppose that the iron ore is limited to the small island of Raasay, as the same geological conditions exist on the adjoining part of the island of Skye. We need more iron-ore reserves, and this recent development, together with the occurrence of oil-shale, suggests that the island of Skye might be a profitable field for scientific prospecting.

DONALD F. CAMPBELL.

London, November 3.

NOTES ON ASSAY STANDARDS

By R. D. MACKECHNIE.

Copper. For standardizing sodium thiosulphate solution when it is to be used for estimating copper in ore, iodine can be used with advantage. Chemists are apt to forget that the atomic weight of iodine, 126.92 is practically double the atomic weight of copper, 63.57, and that for this titration 2 parts of iodine are equal to 1 part of copper. The sodium thiosulphate solution, then, can be standardized by weighing 0.5 gram of re-sublimed iodine, and proceeding as usual after its solution in potassium iodide; 0.5 gram iodine is equal to 0.25 gram copper. The above is applicable where rapidity more than accuracy is wanted.

Iron. The Sibley iron ore, containing 69.2% iron, sold by the Bureau of Standards, Washington, is a convenient standard; however, any stable iron ore when reliably checked would also serve. With regard to estimating iron in ores, a 2-gram sample is to be preferred to the usual 0.5 gram sample; any error is then multiplied by 50 instead of 200. To facilitate the use of a larger quantity of ore for estimation, potassium bichromate that has been recrystallized at least three times may be dried at 100° C., and a convenient quantity dissolved and made to perform the greater part of the oxidation of the reduced ore solution, the final titration being made by using N/10 potassium bichromate solution. For example, when using 2 grams of the ore sample, 0.8 gram potassium bichromate is equal to 45.53% iron, and each 0.5 c.c. N/10 potassium bichromate solution is equal to 0.14% iron. For recrystallizing the potassium bichromate purchased as pure, the dissolved salt should show a specific gravity of 1.36 at 100° C. if the best crystals are desired.

Phosphoric Acid. As a reliable source of phosphoric acid the salt potassium dihydric phosphate does not appear to be well known. The use of this salt is recommended in Sutton's 'Volumetric Analysis' because it does not alter on exposure to air and forms a clear solution, which is more than can be said of other common soluble phosphates. Potassium dihydric phosphate is prepared by adding pure solution of potassium carbonate to pure phosphoric acid until alkaline to methyl orange and concentrating to 1.35 specific gravity before crystallizing. The salt contains 52.2% phosphoric anhydride, and a convenient solution is one containing 3.83 grams of the salt per litre.

QUOTATIONS

of leading mining shares on the London Market.
Shares are £1 par value except where otherwise noted.
Quotations are given in shillings.

	Nov. 1 1912	Oct. 1 1913	Nov. 1 1913
GOLD, SILVER, DIAMONDS.			
RAND:			
Bantjes.....	25	15	13
Brakpan.....	77	56	52
Central Mining (£12).....	192	172	165
Cinderella.....	20	6	5
City & Suburban (£4).....	45	46	46
Consolidated Gold Fields.....	70	49	45
Consolidated Langlaagte.....	27	26	27
Consolidated Main Reef.....	18	17	17
Crown Mines (10s.).....	136	128	125
Durban Rodepoort.....	23	17	16
D. Rodepoort Deep.....	23	18	20
East Rand Proprietary.....	57	46	42
Ferreira Deep.....	27	58	67
Geduld.....	22	22	20
Goldenhuis Deep.....	27	27	26
Heriot.....	80	60	60
Jupiter.....	12	3	3
Kleinfontein.....	25	23	22
Knight Central.....	12	6	6
Knight's Deep.....	47	32	26
Langlaagte Estate.....	28	21	18
Main Reef West.....	20	8	8
Meyer & Charlton.....	98	100	97
Modderfontein B.....	64	74	77
Modderfontein, New (£4).....	238	225	225
Nourse.....	38	28	30
Primrose.....	38	28	28
Rand Mines (5s.).....	125	121	119
Randfontein Central.....	26	24	23
Robinson (4s.).....	70	52	50
Robinson Deep.....	45	30	30
Rose Deep.....	58	52	46
Simmer & Jack.....	19	12	11
Simmer Deep.....	3	2	1
Springs.....	16	15	12
Van Ryn.....	73	67	66
Van Ryn Deep.....	18	33	35
Village Deep.....	42	36	36
Village Main Reef.....	47	36	36
Witwatersrand (Knight's).....	58	70	68
Witwatersrand Deep.....	54	56	57
Wolhuter.....	20	15	14
RHODESIA			
Cam & Motor.....	35	30	27
Chartered.....	25	21	21
Eldorado.....	32	16	13
Enterprise.....	17	14	11
Falcon.....	22	19	16
Giant.....	33	16	13
Globe & Phoenix (5s.).....	31	27	27
Lomely Reef.....	56	55	41
Shamva.....	61	40	36
Wanderer (5s.).....	2	1	1
OTHERS IN SOUTH AFRICA			
De Beers (£2 10s.).....	393	405	370
Glynn's Lydenburg.....	25	16	15
Jagersfontein.....	123	126	102
Premier Diamond (2s. 6d.).....	233	217	205
Transvaal Gold Mining Estates.....	56	53	51
WEST AFRICA:			
Abbottiakoon (10s.).....	6	5	5
Abooso.....	18	13	12
Ashanti (4s.).....	20	18	16
Broomassie (10s.).....	4	6	6
Prestea Block A.....	16	12	10
Taquaah.....	14	11	11
WEST AUSTRALIA			
Associated Gold Mines.....	7	7	7
Associated Northern Blocks.....	6	11	11
Dee Beech.....	9	12	12
Golden Horse Shoe (1s.).....	41	53	53
Great Boulder Proprietary (5s.).....	11	13	13
Great Boulder Perseverance.....	2	2	2
Great English.....	10	11	12
Great English (5s.).....	74	61	56
Great Hill.....	42	41	41
Great Hill Gwalia.....	21	1	1
Yarrow.....	10	8	6

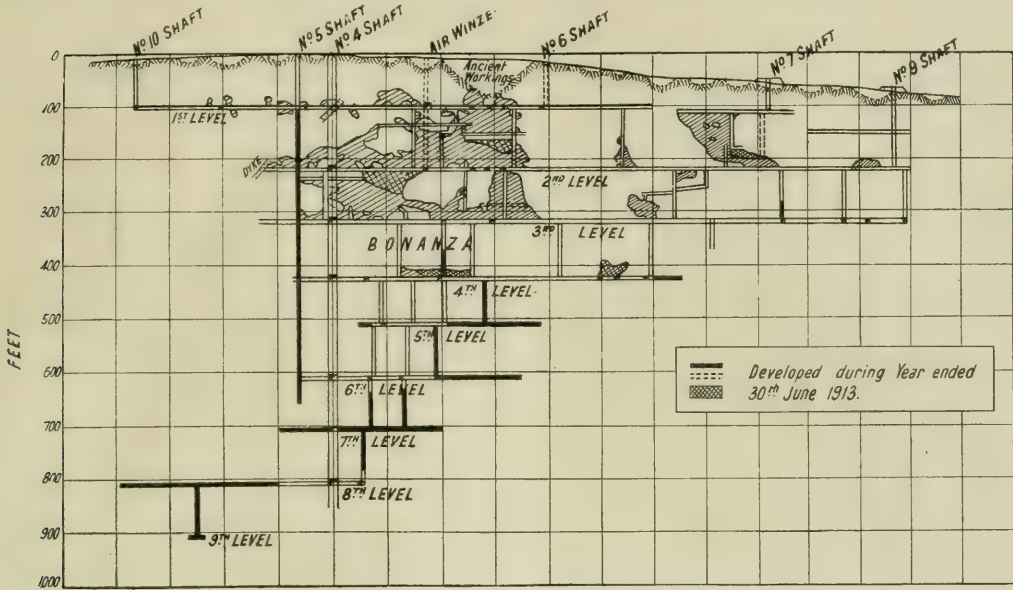
	Nov. 1 1912	Oct. 1 1913	Nov. 1 1913
OTHERS IN AUSTRALASIA			
Mount Boppy.....	27	15	15
Mount Morgan.....	62	72	70
Talisman.....	35	42	42
Tasmania Gold (10s.).....	2	1	1
Waihi.....	31	51	55
Waihi Grand Junction.....	21	22	25
AMERICA:			
Alaska Treadwell (£5).....	160	165	165
Buena Tierra.....	20	17	17
Butters Salvador.....	40	40	40
Camp Bird.....	25	16	14
El Oro.....	16	15	14
Esperanza.....	41	18	16
Granville.....	15	12	11
Mexico Mines of El Oro.....	135	117	107
Oroville Dredging.....	5	6	7
St. John del Rey.....	16	15	16
Santa Gertrudis.....	27	18	17
Stratton's Independence (2s. 6d.).....	2	2	1
Tomboy.....	26	26	26
RUSSIA:			
Lena Goldfields.....	56	47	42
Orsk Priority.....	20	10	6
Siberian Proprietary.....	12	3	2
INDIA:			
Champion Reef (2s. 6d.).....	12	10	10
Mysore (10s.).....	114	102	102
Nundydroog (10s.).....	35	25	26
Ooregum (10s.).....	17	21	21
COPPER:			
Anaconda (£5).....	176	152	145
Arizona (5s.).....	41	40	38
Cape Copper (£2).....	130	115	112
Chillagoe (10s.).....	3	1	1
Great Cobar (£5).....	77	35	23
Great Fitzroy (5s.).....	1	2	3
Hampden Cloncurry.....	49	37	38
Kyshtim.....	61	63	62
Messina (5s.).....	21	30	27
Mount Elliott (£5).....	146	97	93
Mount Lyell.....	23	26	25
Rio Tinto (£5).....	1472	1575	1540
South American Copper (2s.).....	31	33	32
Spassky.....	72	55	60
Tanganyika.....	50	47	44
Tharsis (£2).....	125	152	147
Whim Well.....	23	15	12
LEAD-ZINC:			
BROKEN HILL:			
Amalgamated Zinc.....	37	30	27
British Broken Hill.....	47	38	38
Broken Hill Proprietary (8s.).....	46	36	35
Broken Hill Block 10 (£10).....	40	27	34
Broken Hill Block 14 (25s.).....	9	8	7
Broken Hill North.....	146	48	53*
Broken Hill South.....	156	145	146
Sulphide Corporation (15s.).....	27	27	24
Zinc Corporation (10s.).....	17	17	17
TIN:			
NIGERIA:			
Abu (5s.).....	—	14	12
Bisitchi.....	21	20	17
Jos (5s.).....	6	9	8
Kaduna (5s.).....	22	20	18
Naraguta.....	27	38	36
Nigerian Tin.....	22	30	27
N. Nigeria Bauchi (10s.).....	5	4	3
Ravfield.....	16	21	17
Ropp.....	45	142	135
OTHER COUNTRIES:			
Aramayo Francke.....	20	35	35
Biscuits.....	8	8	7
Cornwall Tailings.....	38	21	20
Dalcoath.....	23	19	20
Gaeror (10s.).....	17	22	21
Gopeng.....	75	31	28*
Mawchi.....	28	22	21
Roonberg.....	34	28	30
Tekka.....	72	67	67
Trench.....	66	51	46

* Calendar arranged during year.

PRÉCIS OF TECHNOLOGY

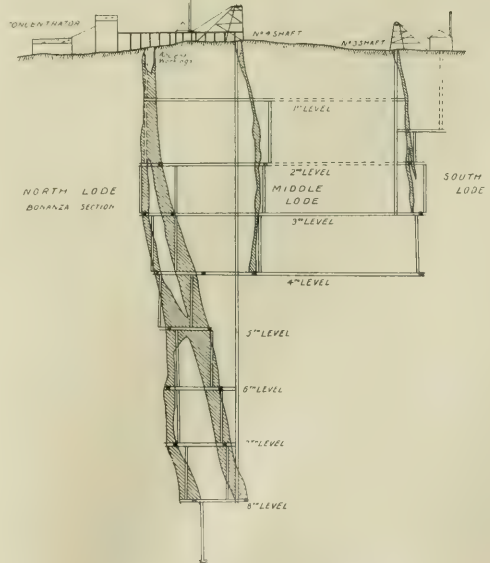
The Messina Copper Mine.—The August issue of the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by J. Allan Woodburn on the Messina copper mine, in the

The accompanying vertical sections shows the amount of work done to date. The North lode has been exposed for 1500 ft. along the strike on the 2nd level, and has been proved to a depth of 900 ft. The ore-shoots consist of a series of lenticular masses having no observable connection between each other.



LONGITUDINAL SECTION OF NORTH LODGE.

Northern Transvaal. Attention was originally attracted to this deposit by the numerous ancient workings. These are all open-cuts, and some are as deep as 80 ft. Most of them have been filled with debris, presumably by the old miners as the faces advanced. The workings approximately follow three lines, which have since been identified with definite lodes, and named the North, Middle, and South lodes. Their general trend is northeast to southwest, and they appear to approach each other toward the west. The country for a mile round the mine is granite, with hornblende-gabbro dikes penetrating it in various directions. On the line of lodes many other rocks are found, principally decomposed or altered granites. Both red and grey granites, frequently of a gneissic structure, are exposed in the cross-cuts between the lodes. Soft decomposed felsites, in substance like china-clay, and coloured yellow, red, or green, are associated with the lodes in some places. Elsewhere white quartz is the gangue of the lodes. The copper minerals are chalcocite, bornite, and chalcopyrite, and they are found occasionally in large irregular blocks, at other places cemented in the cracks of the quartz or disseminated through its mass. When prospecting was started, seven shafts were sunk, three on the line of the North lode, three on the South, and one on the Middle. At first the results were disappointing. It was not until cross-cuts were driven on the 1st and 2nd levels from the shaft on the Middle lode to the North lode that a large body of ore was found in the latter. This was called the Bonanza. It forms part of the North lode, and on the upper levels was about 100 ft. long and from 25 to 40 ft. thick, consisting of chalcopyrite and bornite mixed with felsite.



Section across the Three Lodes.

The lode is generally 3 to 4 ft. wide, with granite walls. At places it widens to 10 or 20 ft. and includes granite horses. In the Bonanza section the copper minerals are disseminated in irregular blocks throughout the mass, and the gangue and country rock are

much decomposed. In depth the proportion of chalcopryite decreases. Below the 3rd level the Bonanza section splits into two parts. The Middle lode is more erratic than the North lode and is about 2 ft. wide, consisting of bornite and chalcopryite, widening occasionally to 20 ft. with horses of granite intercalated. The South lode has been worked to the 4th level and consists of chalcocite and quartz within hard granite walls. Occasionally it splits into two parts, each about 3 ft. thick, separated by 3 to 6 ft. granite through which stringers of ore penetrate from one side to the other. Mr. Woodburn describes in detail the methods of mining, drawing attention to the requirements in connection with the softness of the lode and country rock on the Bonanza section.

Ventilation on the Rand.—At the September meeting of the Chemical, Metallurgical, and Mining Society of South Africa, G. H. Blenkinsop read a paper on the ventilation of deep mines, especially in connection with the Rand. He urged that the system of exhausting the air by means of fans at the top of upcast shafts did not fully meet the requirements, for several reasons. In the first place, the current of air took the line of least resistance between the downcast and upcast shafts, and did not necessarily reach all the workings, and would seldom arrive at the actual faces; so that an elaborate system of doors and partitions is absolutely necessary. Second, the current of air will pass through disused workings, and will there become contaminated by contact with human excreta and other filth, for it is notorious that the irresponsible native is an offender against the laws of health in this connection. Mr. Blenkinsop in fact considers the dry-walling and sand-filling now adopted to be as important in its influence in preventing the 'committing of nuisance' as in supporting the hanging wall. Third, the current of air during its long passage along the workings becomes heated by contact with the rock, and by the time it arrives at the working faces may be 30° higher than when it entered the downcast shaft; moreover it will have become laden with dust. Mr. Blenkinsop urges that arrangements should be made to deliver fresh and uncontaminated air at the working faces. The air should be delivered under a pressure of 8 to 12 oz. from a blower at the surface through pipes to tanks at various stations, and from there distributed by smaller pipes to the faces. He estimates that such an installation for a mine employing 2000 men would cost about £10,000. In reply to criticism that the discharge of air under pressure would tend to raise dust, Mr. Blenkinsop stated that the air would not be discharged direct from the small pipes, but into a bell-shaped piece about 6 ft. long and having a diameter of 9 in. at the end. The pressure of air would thus be reduced, and there would be little draught.

Electric Blasting.—In the *South African Mining Journal* for September 27, E. J. Moynihan discusses the advantages of electric blasting as applied to dry mines. Mr. Moynihan has taken a leading part for many years in the agitation for better underground conditions, especially for the purpose of preventing the miner working in a dust-laden atmosphere. He has urged that blasting should be controlled from the surface and conducted after all the men have left the mine. The system has lately been adopted by the Albu group at the Meyer & Charlton mine. In his article, Mr. Moynihan discusses many points of detail. He shows that though the electric fuses are more costly than the ordinary fuses, there are many counterbalancing advantages. The cheesa stick or firing torch is eliminated. As the miner has not to do his

own firing, he can devote a correspondingly greater time during his shift to drilling, or alternatively spend less time underground. Misfires and premature explosions are largely eliminated. As the men are out of the mine, methods of rapidly settling the dust can be employed that are impossible while the men are underground; for instance, steam could be sent down the compressed-air mains and discharged in the neighbourhood of the blasts. Precautions would be necessary to ensure that all the electric connections are perfect, and that none but the authorized persons have access to the distributing wires. A telephone or a cheap substitute should be used so that the shots can be heard by the blasting operator, though it is not quite clear how a record can be made of all the shots if they are done simultaneously. When the hanging wall is weak, Mr. Moynihan recommends that two systems of conductors should be used connecting with alternate levels.

Ore-Crushing Underground.—The *South African Mining Journal* for October 4 records that at Knights, the mine belonging to the Witwatersrand Gold Mining Company, a new departure has been made by the adoption of ore-crushing underground. Some of the stopes in the mine are very large, and pieces of rock of considerable size which are liable to foul the grizzly are broken. In order to economize the native labour and to dispense with boys hitherto engaged in breaking these large rocks, a rock-breaker has been installed on the 14th level, and the discharge fed direct into the shaft-bins. This is the first rock-breaker to be employed underground in South Africa. Underground breaking is practiced in other mining districts. For instance, in the Round Mountain Mining Co.'s mine, at Round Mountain, Nevada, there are two crusher stations. Careful inquiries regarding the effect of underground crushing on the mine atmosphere indicate that the breaker is giving no trouble in this respect. The crusher station is surrounded by atomizers, and the amount of dust escaping is said to be infinitesimal.

The Mysore Winding-Engine Accident.—As briefly recorded in our September issue, a serious accident occurred at the Edgar vertical shaft at the Mysore gold mine, India. W. F. Smeeth, the Government Inspector of Mines, has issued a report, which should be read by engineers responsible for winding engines. On August 21 the south cage in Edgar's shaft fell from 100 ft. below surface to the bottom of the shaft, a distance of 2600 ft. The cage has two compartments, one above the other, in each of which 25 men can travel. At the time of the accident there were altogether 42 persons in the cage, all of whom must have been killed instantaneously when the cage reached the bottom. When the cage fell, at 100 ft. from surface, it was on the downward trip, and travelling at 1200 to 1300 ft. per minute.

The shaft was completed two years ago. The cages run on steel guides without safety catches. There are two cages, one of which ascends as the other descends, each cage being suspended by a flat steel rope passing over a pulley at the top of the head-gear and led from thence into the engine-room, where it is coiled round a flat drum 16 ft. in diameter. Each drum is mounted on the main engine-shaft, but is not rigidly fixed to it. While winding is going on, the drum is secured to the main shaft by means of a clutch, which in the present engine is in the form of a steel band, lined with wood, acting on the drum like a band brake. One end of this steel band is attached to a fixing on the shaft through an adjusting link for taking up wear and regulating the tension of the clutch band. The accident was due to the snapping of this link, which released the clutch

and left the drum, on which the winding rope is coiled, free to revolve on the shaft and therefore disconnected from the engine. The link which snapped is in the form of a bolt $3\frac{3}{4}$ in. diam., made of mild steel, and appeared to be amply strong enough. When Mr. Smeeth inspected the engine the day after the accident, the broken pieces of the link were still in position, and the fractures were perfectly clean and fresh. There was no appearance of any flaw, but it would be impossible to say whether any molecular alteration had been set up without further examination.

Each drum is provided with a powerful post-brake capable of controlling its rotation whether the drum is clutched to the shaft or not under ordinary working conditions. These brakes appear to have been in perfect working order, and are in constant use every day. At the moment when the link snapped and the south drum became de-clutched from the main engine-shaft, the south cage with 42 men was 100 ft. below surface, and the north cage with 21 men in it was 100 ft. above the bottom of the shaft, the former descending and the latter ascending. The engine-driver heard the snap of the link, and, without being able to recognize what had happened, immediately cut-off steam and applied the two brakes, which are worked by two small engines. The promptness of this action is shown by the fact that the north cage was brought to rest 150 ft. above the bottom of the shaft, so that it travelled only 50 ft. after the snap took place. In other words, after the snap was heard the engine-driver cut-off steam, applied the brakes, and brought the north cage to rest within a space of a few seconds, and the cage with its burden of 21 men remained suspended in the shaft for three hours or so until it was ascertained that it was safe to lower again to the bottom. In this case, the weight of the cage, rope, &c., helped the brake to overcome the momentum of the moving masses.

In the case of the south cage, which was descending, the whole work devolved upon the brake, which failed to bring the drum and the cage to a standstill. The friction of the brake-blocks on the brake-drum was so great that the wooden brake-blocks were charred and the engine-room filled with smoke in a few seconds. The engine-driver stuck to his post, though he could do nothing further, while the drum revolved in a cloud of smoke, and after the cage had struck the bottom the rope continued to pay out until the 14 spare coils were unwound, and finally the plates and bolts which attach the rope to the drum of the reel were torn off and disappeared through the roof of the engine house.

So far as Mr. Smeeth can see, there was nothing wrong with the brakes or the clutches or anything else, and the sudden failure of the adjusting link is one of those unforeseen contingencies for which it is not possible to account. On the other hand, this accident must raise questions as to the mechanical soundness of the particular type of clutch employed and as to the efficiency of the types of brake now employed on large winding engines with heavy loads and working at great depths. The question of brakes has already been the subject of protracted discussion in various parts of the world, and is by no means finally settled.

Selenide Gold Ores.—The *Australian Mining Standard* for August 28 contains a notice of a process invented by J. H. Niemann for extracting gold from the selenide ores found in the Pine Creek district of the Northern Territory of Australia, inland from Port Darwin. The gold deposits in this district have proved disappointing and are mostly abandoned. Mr. Niemann reports that the failure of these ores is due to the association of selenides with the sulphides. The selenide of gold, being volatile, is easily lost in roast-

ing, and in amalgamation the amalgam of selenium and gold is washed away. The cyanide process has not been adapted yet to the particular requirements. Mr. Niemann has invented a process based on volatilization of the selenide of gold, without roasting the sulphide. Particulars however are not given, and the nature of the article generally is not quite convincing.

Gold Production during 1912.—The editor of the *Engineering and Mining Journal* gives his revised figures for the gold production of the world in the issue of October 4. We reproduce these figures herewith, accompanied by the figures for 1911 from the same source :

	1911 \$	1912 \$
Transvaal.....	170,059,273	188,599,260
Rhodesia	12,986,000	13,166,230
West Africa.....	5,197,488	7,386,028
Madagascar, Egypt, etc. ...	2,706,639	2,925,000
United States	96,890,000	93,451,500
Mexico	24,880,100	22,500,000
Canada	9,762,100	12,559,288
Central America, etc.....	3,399,000	3,632,500
Russia, including Siberia....	32,151,600	27,635,500
France.....	1,707,100	1,847,000
Elsewhere in Europe.....	2,584,900	3,615,000
British India	11,054,100	12,115,162
British & Dutch East Indies	4,726,500	4,925,000
Japan and Korea.....	6,896,900	7,165,000
China, etc.	3,769,600	3,750,000
South America	10,421,800	12,425,000
Australasia	60,184,200	56,635,800
Total	459,377,300	474,333,268

In English money the total figures for 1911 are approximately £94,400,000, and for 1912 £97,500,000. The increase for the year 1912 was due almost entirely to South Africa. The only other country showing an increase was Canada. As regards the prospects of gold production during 1913, there is no likelihood of an increase in the total figures above those for 1912. The United States will not show any material change, and the disturbances in Mexico will cause a set-back. The monthly returns from Australasia so far this year foreshadow a decrease. Canada may be expected to gain, and possibly Russia and Siberia. The outlook for the Transvaal is uncertain, owing to the miners' strike and its results.

The *Engineering and Mining Journal* publishes the following table giving the gold output of the world during the last twenty years :

TOTAL GOLD OUTPUT OF THE WORLD DURING LAST 20 YEARS.			
	\$		\$
1893.....	158,437,551	1903.....	329,475,401
1894.....	182,509,283	1904.....	349,088,293
1895.....	198,995,741	1905.....	378,411,054
1896.....	211,242,081	1906.....	405,551,022
1897.....	237,833,984	1907.....	411,294,458
1898.....	287,327,833	1908.....	443,434,527
1899.....	311,505,947	1909.....	459,927,482
1900.....	258,829,703	1910.....	454,213,649
1901.....	260,877,429	1911.....	459,377,300
1902.....	298,812,493	1912.....	474,333,268

The Channel Tunnel.—In our last issue we gave a short précis of a paper describing the plans for the Channel Tunnel, according to the scheme now being revived. The paper on which we founded the précis was unfortunately not accompanied by illustrations, and in consequence the details we gave were not easy to grasp. The *Engineer* for October 3 contains an article on the subject, fully illustrated, so in order to make our description complete we reproduce some of them herewith. It will be seen that spur lines are to be built from the South Eastern line, west of Dover, and from the Chatham line, north of Dover, to meet at a new station a mile northwest of the harbour, and from thence a descending line will be built that will plunge below the Channel west of Shakespeare Cliff. There will be two single-track tunnels of 18 ft. internal diameter, spaced 32 ft. apart from cen-

Nothing has retarded the progress of electricity in Cornish mines so much as the trouble experienced with turbine pumps used for unwatering purposes, whenever an attempt has been made to pump comparatively small quantities of gritty water through small passages with impellers running with small clearances at high speeds. Under these circumstances small machines with high efficiency are not necessarily the best. It is better to have slightly less efficiency with a pump of more robust type that will keep up to its initial duty. It is not advisable to use high-lift pumps for unwatering purposes. It is more economical to use two pumps with a lift of 500 ft. each than one with a lift of 1000 ft. A type of pump that Mr. Hards would like to see tried in Cornwall is the Rees-Roturbo. This has a larger clearance than other pumps of the same type, an advantage for use with



ROUTE OF CHANNEL TUNNEL, AND RAILWAY CONNECTIONS.

tre to centre, and a drainage heading below, 11 ft. in diameter. The latter will be driven first, and it will serve as well for the removal of the excavated rock from the two tunnels. The length of the drainage heading will be 24 miles, and the length of the two tunnels including the approaches at each end will be 31 miles. The borings will all be in the grey chalk, which contains few fissures and is remarkably dry. The map shows that the tunnel is not straight between the two sides. The reason for the curved path is the intention of keeping the tunnel in the centre of the grey chalk. The tunnels and heading will be lined with cast-iron segments and the space between them and the rock will be firmly grouted.

Electricity in Mines.—At the meeting of the Cornish Institute of Mining, Mechanical, and Metallurgical Engineers, held on October 4, L. A. Hards read a paper on the 'Application of Electricity to Cornish Mining.' Mr. Hards is the manager and engineer for the Cornwall Electric Power Company, the central station of which, at Hayle, sells about 20 million units per year. In his paper he discussed the application of electric power to pumps, rock-drills, compressors, stamps, concentrators, etc

gritty water, and it has the advantage that it maintains its efficiency over a wide range of head. With low heads it will pump large quantities of water without it being necessary to close the valve on the delivery, which in many cases has to be done in order to prevent overloading the motor.

In discussing the general question of unwatering mines and sinking operations, Mr. Hards suggests that it would be possible to have one or two single-stage sinking-pumps below the main pump, capable of pumping 40 to 50 ft., delivering to a tank 3½ ft. square and 10 ft. long, from which the large pump could pump intermittently. Such an arrangement would prevent the chokes that so often cause trouble while unwatering, and a further advantage would be that large pumps would not have to be moved so frequently. The ideal arrangement in a mine would be to have pumps, running intermittently, placed at various levels on moderate heads, and to make efforts to keep the water from reaching the lower levels, thus reducing the height through which it has to be pumped.

There is no difficulty in driving any type of stamp. The Holman stamp lends itself most readily to the electric drive, for only one reduction of speed is neces-

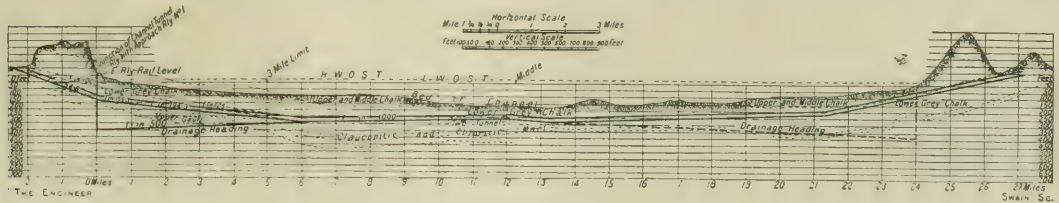
sary. At Dolcoath these stamps are driven in this way without a counter-shaft, by a single belt from the motor-shaft. With regard to Californian stamps, the power required is small, but an appreciable proportion is wasted owing to the necessity of having a double reduction of speed. Mr. Hards suggests that a modified single cam should be invented so as to give the same number of lifts per minute from a shaft revolving at twice the speed, or that chain-drives should be substituted for belts.

No electric winder has yet been installed in Cornwall.

Iron Ores of Brazil.—At the October meeting of the Institution of Mining and Metallurgy, J. H. Goodchild presented a paper entitled 'Laterization in Minas Geraes, Brazil.' He described in detail the nature of the many varieties of soft iron ore found in this region, and the nature of the physical changes undergone by

or removal of the electrolyte by long-continued dialysis of the coarsely dispersed precipitate suspended in the pure dispersion medium. Removal of the electrolyte prevents coagulation. But the removal of the electrolyte is not enough to account for the increase in the degree of dispersion. We must suppose that precipitates of this kind possess free expansive surface-tension toward pure water, that is, solubility, and, in fact, colloidal solubility.

(b) Etching process. Many precipitates cannot be brought directly into the colloid state by the removal of the electrolytic impurities by washing or dialysis, but require a preliminary treatment with acids, bases, salts, etc. The precipitates are usually washed alternately with electrolyte solutions and pure water. High temperature is advantageous. After these processes have been carried on for a certain time the precipitate dissolves in pure water to a colloid solution.



VERTICAL SECTION OF CHANNEL TUNNEL.

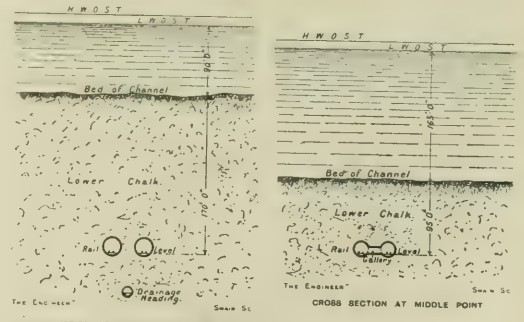
the country, the information given being founded on the results of his observations during a long period of residence. He discussed the views as to the origin of the ores expressed by O. A. Derby, C. K. Leith and E. C. Harder, H. K. Scott, and T. Gathmann. We will not quote his description of these deposits and ores, itabariite, jacutinga, canga, and hematite, as we referred to the subject in our precis of Leith and Harder's paper in the issue of January 1912, but we will content ourselves with an exposition of Mr. Goodchild's suggestion for a possible explanation of the formation of the secondary deposits. He shows that the nature of the alteration of the rocks is allied to laterization, that is to say, the decomposition of the silicates, etc., contained in them into oxides and the formation of a soft and porous material which hardens when exposed to the air. Instead of the term 'lard sculpture' he proposes 'digestion' for the process of reaction. Proceeding further he judges that the reagents were akin to the organic, and he introduces the idea of colloid chemistry.

We consider that Mr. Goodchild was unnecessarily apologetic when introducing his paper at the meeting, for his suggestions will certainly lead to much discussion and investigation, and will thus help in elucidating some of the problems of ore-deposition.

In the language of the physical chemist, all rocks are disperse systems to some extent, as they all contain finely disseminated impurities. Soft rocks in which a liquid is present are particularly likely to exhibit the properties of a dispersoid. The rôle of the colloid state of matter in geological processes would appear to be an important one, and the formation and distribution of laterite affords a particular example.

Colloids are formed in two ways: (1) By dispersion from coarse matter; (2) By condensation from solution. Soft moist rock offers opportunities for both processes to take place. As regards the method of dispersion, Ostwald gives two principal means of effecting it:

(a) Washing out with the pure dispersion medium,



Cross Sections of Channel Tunnel.

The two main conditions for the formation of colloids by condensation are given by Ostwald as follows:

(c) The substance, formed by the reaction, which is to be brought into the colloid state, must not be, or only slightly, capable of passing into molecularly disperse solution in the reaction medium.

(d) Care must be taken that the separation of the insoluble, or only slightly soluble, reaction-product takes place under conditions which prevent the growth or fusion of the separating particles to aggregates of a lower degree of dispersion than the colloidal.

These principles bear on the existence of colloids under the conditions reigning where lateritic deposits are found abnormally developed. (a) Plenty of pure water; (b) Alternate treatment with acids, etc., followed by dialysis or washing; (c) Insolubility of the reaction-product; (d) Prevention of aggregations. All these conditions would seem to be fulfilled where, for instance, a rock containing ferro-magnesium silicates is acted upon alternately by carbonic acid, nitric acid, products of organic decay, rain water, with the resulting formation of insoluble oxides of iron, silicic acid, carbonates of lime and magnesia, the process taking

place in a porous medium formed automatically by the decomposition, so that the products of reaction do not aggregate to form precipitates.

It therefore seems possible to amplify the conception of Maclaren as to the mode of formation of lateritic deposits by the aid of these principles, and the 'natural laws of growth' of the products of reaction of which he speaks become a problem of colloid chemistry. If, however, we attempt to follow up speculation further by a consideration of the behaviour of colloids, we are at once lost in a maze of possibilities. The outstanding features of colloids is their instability. The slightest change in conditions may produce the most important results. Bodies in the colloid state are sensitive to slight changes of temperature, pressure, and concentration; they are influenced by electricity, radiations of all kinds, and so on. When so influenced they gelatinize, coagulate, crystallize, are peptonized, absorbed, or endowed with powers of movement of direction.

If we remember that the colloidal solutions of oxides and silica present in the surface rocks are submitted to daily and seasonal cycles of changes, and that at any moment irreversible forms may be produced, then the extraordinary variations in composition and structure of iron laterite, itabirite, etc., present no difficulties to the imagination.

Mineralogical Studies on Tomboy Concentrate.—In *Economic Geology* for September, J. F. Kemp has a paper entitled 'Artificial Vein-Formation in the Tomboy Mill, Telluride, Colorado,' discussing the alteration of concentrate due to the heat of the drying apparatus. The concentrate is dried by means of steam-pipes, and these pipes had been for two years covered by a layer of concentrate, which was not disturbed during that time. When reorganizing the plant in 1912, Gelasio Caetani found that the layer had become cemented into a firm mass, and that the constituents of the concentrate had become segregated, the silicious content surrounding the pipes for a thickness of a quarter of an inch. Specimens of the hardened mass were sent to Professor Kemp, who made a mineralogical analysis, and deduced a theory for the rearrangement of the particles. The action has been analogous to vein-formation, taking place at comparatively low temperature and in a brief period of time. The Tomboy concentrate has the following constitution by weight: Pyrite 29%, blende 34.4%, chalcopryrite 12.6%, galena 4.2%, and quartz 14.3%; the remaining 5.5% is made up of gold, silver, calcite, siderite, calcite, fluorite, sericite, kaolinite, etc. Roughly speaking 80% is metallic sulphides, and the rest gangue matter of which the greater part is quartz. The average size of the particles is a fiftieth to a hundredth of an inch. There can be no doubt that when the concentrate was placed round the steam-pipes the mixture was uniform. As already stated, the hardened cake consists, for a thickness of $\frac{1}{4}$ in. next the pipes, of silica almost entirely devoid of sulphide particle. Any occasional particle of pyrite has a rim of limonite, and there is a constant band of limonite parallel with the surface of the pipes and close to the outside of the silicious layer. Apparently the silica, in hydrated form, has moved toward the pipes and displaced the particles of sulphide which have become segregated farther away. Under the microscope, the matrix appears as a transparent mass with cloudy streaks, resembling chert and flint. With polarized light, the mass is resolved for the most part into extremely small, brightly polarizing points and rods. The greater number of them are undoubtedly quartz. They form nests of small radiating crystals, such as

are seen on a larger scale associated with agate. There are also occasional bundles of fine, brightly polarizing needles or fibres in close aggregates; these are doubtless chalcedony. There are suggestions of former fragmental textures, now mostly obliterated, as if the silica had passed through a gelatinous stage, and had recrystallized as quartz and chalcedony. The sections occasionally contain rectangular rods, with cross cleavages, brightly polarizing with parallel extinction. These may be calamine, for they are observed as fringes round particles of blende. Mr. Kemp gives the method of production of this solidified mass that so clearly imitates a banded vein. Silica, probably in the gelatinous state, has formed next the steam-pipes, and has crowded back the metallic particles so as to create a band quite free from them. In the process, some of the pyrite has been oxidized and hydrated to form limonite. At the same time, sulphuric acid has probably been set free, and it may have exercised some influence on the final result. Pyrite grains may be detected with limonite rims still surviving. The limonite has however been almost entirely segregated in a narrow wavy band within the silicious layer and nearer to the metallic particles than the steam-pipes. This relationship is much the same as that obtained by artificially producing metallic precipitates in gelatinous substances. Apparently the ferric hydrate, as formed in the gel, spreads into a narrow band roughly parallel to the surface of the pipes. It is possible that some of it came from the iron of the pipes. Within the distance of $\frac{1}{2}$ in., the heat of the pipes has been effective in producing the gelatinous silica, but beyond this sphere of influence the concentrate remained loose, and no crust formed. Within the zone, the particles of sulphides are cemented into a solid mass by the silica, but there has been no zonal or parallel development of bands, and the metallic sulphides have not been visibly affected.

CURRENT LITERATURE.

Rand Banket.—A series of articles on this subject, written by C. B. Horwood, commences in the *Mining and Scientific Press* for October 11. An introductory article by T. A. Rickard accompanies.

Secondary Enrichment.—In *Economic Geology* for August, Frank T. Grout describes experiments undertaken at the instance of W. H. Emmons in connection with the possible reagents effective in enriching sulphide ores under weathering conditions. The experiments were on the precipitating effect of cold acid sulphate solutions on metallic sulphides held in alkaline solutions.

Secondary Enrichment.—At the October meeting of the Institution of Mining and Metallurgy, W. F. A. Thomae described the secondary enrichment at the Mazapil copper mine, Zacatecas, Mexico.

Charcoal as a Precipitant of Gold.—At the October meeting of the Institution of Mining and Metallurgy, a paper by Morris Green was presented, describing experiments indicating that the power of charcoal as a precipitant of gold from cyanide solutions is due to occluded gases, the chief active one being carbon monoxide.

Howe's Volatilization Process.—In our issue of March last, we gave particulars of the volatilization process devised by Ben Howe for treating the refractory gold ores at the Gwalia Consolidated, West Australia. Unfortunately shortness of funds caused the experiments on a large scale to be abandoned.

Further particulars of the work done appear in the *Mining and Scientific Press* for October 4 and in the *Australian Mining Standard* for August 28.

Broken Hill Practice.—The *Mining and Engineering Review* for August and September contains an article by R. J. Donaldson on the Central mine, belonging to the Sulphide Corporation, describing also the metallurgical plant.

Metallurgy at Cobalt, Ontario.—The *Mining and Scientific Press* for September 27 contains a detailed article by J. J. Denny, metallurgist at the Nipissing mines, describing his process for precipitating silver from complex sulphides by treatment with caustic soda and metallic aluminium, and recovering the silver subsequently by cyanide. A short note on this process was published in our last issue.

Leaching at Butte.—In the *Mining and Engineering World* (Chicago) for September 6 and October 4, Peter E. Peterson describes the leaching plants treating oxidized ores used respectively by the Butte-Duluth and the Bullwhacker companies operating at Butte, Montana.

Electric Zinc.—*Metallurgical and Chemical Engineering* for October reprints a paper by Peter E. Peterson, presented to the American Electro-chemical Society at the September Meeting, describing his experiments conducted at Butte in connection with the electric smelting of zinc ores.

Natural Gas.—In *Economic Geology* for September, Frederick G. Clapp gives an outline of the geology of natural gas in the United States.

Kent Coal.—In the *Colliery Guardian* for October 10, Malcolm Burr gives the results of a number of recent borings in the Kent coalfield.

BOOKS REVIEWED

Gold Dredging. By T. C. Earl. Cloth, octavo, 210 pages, with many illustrations and maps. London: E. & F. N. Spon. Price 20s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This book, well printed and beautifully illustrated, is anomalous. We do not know, and we are not told, who the author is, or what his qualifications may be for writing authoritatively on the subject of gold dredging. With a fairly wide acquaintance in the technology and personnel of mining, we confess never to have heard of the author. That would not prevent him from preparing a good book, but assuredly the reader is entitled to know by what right, of knowledge or experience, the author undertakes to teach him. Another conspicuous defect of the book is the entire lack of references to the sources of the author's information or to the other writers from whom he has borrowed facts and figures freely. It is quite obvious, from errors in geography, that the author has not been to most of the places mentioned by him, and it is strongly suggested that his familiarity with the subject is confined mainly to Spain, New Zealand, and Tierra del Fuego, the first associated at present chiefly with a fiasco in dredging and the other two with small-scale operations of an entirely local character. On page 76 is a list of 11 New Zealand dredges, the particulars concerning which are averaged, for comparison with 11 other dredges, in various parts of the world, whose salient factors are also averaged. As if such an average, based upon a chance assortment of machines, could have any use whatever! By selection of dredges the averages concerning capacity, size, length, breadth, and so forth, could be varied almost *ad libitum*. On page 86 a comparison is made between

New Zealand and American types, the former being represented by a dredge in Tierra del Fuego for which the latest return—on page 174—is that for 1909. The Californian dredge is one of 3 cu. ft. bucket capacity operated in 1906. Such comparisons are only misleading. No writer should presume to publish such stuff in the guise of up-to-date technical information. On page 167 the costs of the Oroville dredges are given in pence, instead of cents, so that the amount is double what it is in fact. The photographs are re-produced well on surfaced paper; the maps are numerous and useful. The text reads like a catalogue.

T.A.R.

Aviation. By Algernon E. Berriman. Cloth, octavo, 350 pages illustrated. London: Methuen & Co. Price 10s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This timely book is written by the technical editor of *Flight* and of the *Auto*; it is stated to be an introduction to the elements of flight and an explanation of the functions performed by various parts of the aeroplane. It contains an account of practical accomplishment in aviation and includes a historical résumé of progress up to date. Of course, it is interesting. No technologist, whether in mining or architecture, can fail to feel intelligent curiosity in a subject so young and so romantic. Whatever aviation may appear in post-Georgian time, it has all the glamour of the unexpected to those who were born in the decorous days of Queen Victoria. The flying man is not yet common-place, and the thrill of seeing him soar from the solid ground into the heavens is still felt by most of us. Flight is a subject of general interest, particularly to the engineer; for in aviation are applied some of the most recondite principles of mechanics and some of the most ingenious devices for simulating the power of muscle. We are pleasantly reminded of our own link with the development of aviation, for, in our first issue, published in September, 1909, we gave an account of the aerial crossing of the Channel by Bleriot on July 25. For the illustrations accompanying that account we were indebted to the technical editor of *Flight*, namely, the author of the book under review. It is written by a man who understands the motor-engine, who has sampled the sensations of flight, who has studied the scientific principles involved, and has yet not allowed himself to keep his eyes so close to the mechanics as to overlook the poetry of his subject. The lifting force of a relative wind is the essence of flight; the power to begin flying and the ability to continue in the absence of wind are conditioned upon a supply of power. The buzzing propeller plays the part of the flapping wing. A cambered surface is more favourable than a plain surface, as in the sail of a yacht or the wing of a bird. But, cambering, *per se*, introduces the element of instability and calls for the use of a tail. The natural stability of the flat plate without a tail is illustrated by experiments with paper models, detailed in the second chapter. Then follow constructional features of the modern aeroplane, illustrated by excellent drawings and beautiful photographs. Chapters IV., V., and VI. deal with the technique of aviation, so far as it has been ascertained, by practice and observation. Propulsion is given a chapter, followed by a sequel on resistance. The analogy of the bird is always before the air-man. In Chapter X. the cambered wing is investigated, and Lilienthal's 'tangential,' which is the cause of its high efficiency, is explained.

Then comes Part II. Having devoted the first part of the book to the principles of the subject, the author

now proceeds to trace the fascinating history of aviation, beginning with the gliding of Lilienthal and the Wright brothers, to the hopping of Farman and the Voisin brothers, and culminating in the flying of Bleriot, Paulhan, and Graham White. How soon is history made! The three stages of aviation from gliding, to hopping, to real flying are dated 1891, 1904, and 1909. These are the milestones of aviation. The next, even more recent than the time of writing this book, is the demonstration of control in flight, even to inverted motion, by Pegoud in September of this year. The aeroplane may have seemed a fad only two years ago; that it is a serious development of scientific research is made evident by this book. Man has searched for the solution of the problem of flight throughout the ages since *Pithecanthropus* first wondered stupidly at the bird that eluded him so easily on rising wing. Man, in the shape of *homo sapiens*, wonders still, but more intelligently. Aviation has gained national significance; it will achieve industrial importance.

T.A.R.

The Nature and Origin of Fiords. By J. W. Gregory. Cloth, octavo, 550 pages, with many illustrations. London: John Murray. Price 16s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The formation of valleys by tectonic action, and by the eroding forces of wind, water, and ice, has provided a subject of study for all interested in structural geology. The fiords have presented difficulties of explanation, and many geologists have been content to ascribe their origin to glacial action, apparently for the sole reason that they are found in regions where glaciers abound at the present time. It is agreed that they are valleys or estuaries sunk below the sea-level by the agency of earth-movements. They are characterized by steep rocky sides and by unusual depth. As often as not the depth is greater in the upper reaches than at the mouth. A few geologists who have made close study of certain districts have arrived at the conclusion that the fiords were formed at earlier periods than the Glacial age, and that they are the remains of ancient river-courses now submerged by the sea. For instance, J. E. Spurr, 15 years ago enunciated this principle in connection with the fiords of Alaska and British Columbia. The present book, written by Mr. Gregory, the distinguished professor in the University of Glasgow, brings before us a new theory, to the effect that they have been caused by oscillatory earth-movements originating from the rotation of the earth on its axis. We know that the equatorial diameter of the earth is greater than the polar diameter owing to this rotation. We also can observe that the surface of a rotating spheroid when subjected to irregularities of rotation receives the greatest amount of flexure at points approximately two-thirds of the way from the equator to the pole. Thus we can imagine that in the history of the earth these parts have been cracked, lifted up, and depressed below the surface of the ocean to a greater extent than the parts nearer the equator and the poles. The fiord structure is prevalent in these parts of the earth. In the northern hemisphere, Norway, Scotland, and the Pacific coast of Alaska and British Columbia, afford conspicuous examples of fiords; while in the southern hemisphere, Patagonia and the south of New Zealand provide the evidence. Mr. Gregory's book affords exceptionally interesting reading, especially to those who know and appreciate his previous books on the 'Carnegie Rift Valley,' the 'Dead Heart of Australia,' and the 'Making of the Earth.'

The book is founded on personal investigations extending over many years, in Norway, Spitzbergen, British Columbia, New Zealand, Dalmatia, and other countries. The author has collected the literature on the subject and publishes references to a judicious selection of it. Apart from its strictly technical character, the book is to be commended for its evidence of the author's reverence and poetic instinct. E.W.

Outlines of Mineralogy for Geological Students.

By Grenville A. J. Cole. Small octavo, 350 pages, illustrated. London: Longmans, Green & Co. Price 5s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The author of this book is the professor of geology in the Royal College of Science at Dublin, and his books on practical geology have been current for many years.

Igneous Rocks: Composition, Texture, and Classification, Description and Occurrence. Vol. II. By Joseph P. Iddings. Cloth, octavo, 700 pages, illustrated. New York: John Wiley & Sons; London: Chapman & Hall. Price 25s. 6d. For sale at the Technical Bookshop of *The Mining Magazine*.

Five years ago Mr. Iddings published his first volume, on the composition and classification of igneous rocks. The present volume supplements the first, describing the rocks in great variety and giving information relating to their occurrence throughout the world.

Metallurgical Analysis. By N. W. Lord and D. J. Demorest. Cloth, octavo, 340 pages, illustrated. New York: McGraw-Hill Book Co. Price 12s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is a third and revised edition of Lord's book originally published twenty years ago, prepared by Mr. Demorest, his successor in the chair of metallurgy in the Ohio State University.

Report on the Cobar Copper and Gold Field. Part I.

By E. C. Andrews. Paper boards, octavo, 210 pages, with many illustrations and portfolio of maps. Sydney, New South Wales: Department of Mines. Price 7s. 6d. net.

Cobar is the most important copper and gold district in New South Wales at present. English investors have had enough to worry them at the Great Cobar. As regards gold, the Mount Boppy mine has provided them with substantial dividends. The geological survey on which this monograph is based was undertaken during 1910 and 1911, and the report was completed in 1912. It is a pity that there has been so much delay in publication, because the remarks on the Great Cobar enterprise would have been read with greater interest a year ago. For this reason we will not quote extracts, but recommend geologists to secure copies. The part now published deals with the copper deposits. Part II will describe the goldfield.

The Mineral Industry: Its Statistics, Technology, and Trade. Vol. XXI. Edited by Charles Of. Cloth, octavo, 1090 pages, illustrated. New York: McGraw-Hill Book Co. Price 42s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This annual needs no extended notice, as its merits are sufficiently well known. The reviews of technology by C. H. Fulton (Gold), L. S. Austin (Copper), C. F. Tolman, Jr. (Applied Geology), R. H. Richards (Ore Dressing), H. O. Hofman (Lead), and W. R. Ingalls (Zinc), deserve special mention.

COMPANY REPORTS

North Anantapur Gold Mines.—This company was formed in the middle of 1908 by John Taylor & Sons for the purpose of acquiring a gold mine at Anantapur, in Madras Presidency, India. The vendor was the Anantapur Gold Fields, Ltd., which had done the development. The report for the year ended June 30 shows that the profitable stage has been reached, and that the first dividend is to be paid. During the year, 22,827 tons of ore was raised and sent to the mill, where 8911 oz. bullion was extracted. In addition, 5490 tons of tailing was cyanided, yielding 276 oz. bullion, making a total production of 9187 oz., selling for £35,867. These figures compare with 17,568 tons and £24,152 the year before. The cyanide plant was brought into operation in December 1912, and the first return from this source was for the month of February of this year. The plant has a capacity of 3000 tons per month, but owing to the short supply of labour, following epidemics of cholera and malaria, the full figures have not yet been reached. The percentage of recovery by amalgamation and cyaniding is 92.3. The drought of a year ago interfered with milling, and in order to prevent the recurrence of scanty water-supply, a reservoir has been built and water-rights acquired. Development work has given satisfactory results, for the length of the main ore-shoot increases with depth. On the 550-ft. level north of No. 5 shaft the shoot is 335 ft. long, as compared with 282 ft. and 135 ft. on the 450-ft. and 300-ft. levels respectively. A winze below the 550-ft. level has been sunk 70 ft., in ore 5½ ft. wide and assaying 2½ oz. gold per ton. At other parts of the property exploratory work is giving promising results. The reserve of ore on June 30 was estimated at 44,000 tons, being an increase of 2000 tons during the year. The accumulated tailing amounts to 47,000 tons. The working cost during the year was £29,944, in addition to which £1915 has been allowed for depreciation, and £1500 has been written off the preliminary expenses account. Royalty and taxes absorbed £305, and £2000 has been distributed as dividend, being at the rate of 10% on the preference shares. The issued capital of the company is £74,268 in ordinary shares and £20,000 in preference shares. The latter were issued in 1911, and are entitled to a non-cumulative dividend of 20%; the amount called-up on them so far is 16s. per £1 share.

Jibutli Mines of Anantapur.—The property owned by this company was acquired from the Anantapur Gold Field parent company by the Nundydroog company, and after development was handed over to the present company, which was formed for the purpose in June 1911. All these companies belong to John Taylor & Sons' Indian group of gold mines. The capital was originally £220,000 in shares of 10s. each. In November 1912, 50,000 preference shares of 10s. each, entitling the holders to a 20% non-cumulative dividend and subsequently ranking equally with the ordinary shares, were issued, the additional capital being required for the erection of treatment plant. The report now issued, covering the year ended June 30 last, shows that shareholders will again be asked to subscribe working capital, this time for the purpose of extensive underground development. The mill has been erected after delays caused by shortness of labour following an epidemic, and by the bad state of the roads owing to an unusually wet season. The reserve of ore is estimated at 44,000 tons. The manager, W. Stonor, and R. H. P. Bullen, manager of the Ooregum mine, who made an examination, report that profitable ore is being developed at four different

centres of work, and that the prospects are excellent. A sum of £25,000 is needed for the development. In order to raise the capital, the company is to be reconstructed, giving preference shareholders identical rights in the new company, one new ordinary share fully paid being given in exchange for four old ordinary shares, with the right to subscribe for four new shares credited with 8s. paid. If every one takes up the new shares, 330,536 shares will yield 2s. per share, or £33,053. Mr. Stonor's report gives particulars of the metallurgical plant and of the development work at the mine.

Northern Nigeria (Bauchi) Tin Mines.—This company was formed in February 1910 to acquire, from the Anglo-Continental Mines, property at N'Gel on the Bauchi plateau, Northern Nigeria. The control was associated with Edmund Davis and Oliver Wethered, but the latter has recently resigned the position of managing director. C. G. Lush & Co. are the consulting engineers and David H. Bannerman is manager. The issued capital is 255,547 preference and 194,453 ordinary shares of 10s. each, the former being entitled to a non-cumulative dividend of 10% and subsequently ranking equally with the ordinary shares in the distribution of further profits. At the present time, cassiterite is being won by calabashing. A monitor and sluicing plant are on order, and will be put into use whenever the railway communication has been brought nearer. During the year ended June 30 the production of cassiterite was 265 tons. The sales were 262 tons, and the income £39,504, from which must be subtracted £6569 for freight, etc., and £2068 for royalty to the government. The net profit was £17,788, which, added to the balance brought forward from the previous year, makes a disposable profit of £33,998. Out of this, £12,639 has been distributed as a 10% dividend on the preference shares, and the rest has been carried forward. Some of the outlying areas for which the company had prospecting licences have been abandoned, these being in the Geri and Arna districts; and the claims at Bukuru have been withdrawn by the government as the land was required for the railway extension. Mr. Bannerman reports favourably on the prospecting done at N'Gel during the year. The board is desirous of obtaining information and advice at first hand in order to make it possible to elaborate a scheme for future policy. One of the members, G. Temple Harris, is about to visit the property in company with F. M. Lush. The company owns interests in the Gurum River and Jantar companies. The property of the first-named is being developed by J. M. Iles on behalf of the Rayfield company, and the Jantar is already producing tin.

Globe & Phoenix.—The interim report, for the half-year ended June 30 last, of this company owning the largest gold-producing mine in Southern Rhodesia, shows that 36,628 tons of ore was raised and sent to the 40 stamps. The yield by amalgamation was 51,471 oz. gold, from 1555 tons of concentrate 4207 oz. gold was produced, from 22,804 tons of sandy tailing 3825 oz. was recovered, and from 11,535 tons of slime, 3289 oz. The total production of gold was 62,792 oz. The new plant for treating the sandy tailing was started in December 1912, and worked continuously during the half-year, but was put out of commission shortly afterward pending the erection of an ore-drier in front of the roasting furnace. The absence of such a drier caused trouble in the roasters, and greatly added to the cost of treatment of the sand, the cost being no less than 31s. per ton. The cost of treatment based on the ore raised was 43s. 3d. per ton, and the total cost £79,271. The 'working profit' for

the half-year was £163,379. The ore reserve on June 30 was 175,805 tons averaging 30·8 dwt., as compared with 170,945 tons averaging 33·8 dwt. on December 31 last. The ore treated during the half-year was estimated to contain 36 dwt. gold per ton. For the half-year, dividends amounting to 3s. 6d. per 5s. share have been paid. The development reports show that between the 19th and 20th levels the lode is wider and longer than in the levels above, and the indications are favourable to the lode being less broken in further development at depth. The committee of shareholders appointed to investigate and report on the condition of the mine and management of the company have issued a recommendation to reduce the directors extra fees, abolishing the 5% of the profits and substituting 1%. An extraordinary meeting of the company has confirmed this proposition.

Selukwe Columbia Gold.—This company now belongs to the Consolidated Gold Fields group, the control having been acquired two years ago from the original promoters; the Rhodesian Exploration & Development Company. It was floated in 1900 to acquire the Yankee Doodle and other properties in the Selukwe district of Rhodesia. It was reconstructed in 1908, and additional capital was subscribed in 1910, 1911, and 1912. On the last occasion, the Wonderland, Chimborazo, and Danga claims were bought. The metallurgical equipment consists of rolls, a Chilean mill, concentrator, grinding pans, and cyanide plant. The report for the year ended June 30 shows that the ore at the Yankee Doodle is exhausted, and that the mill will have to cease operations for a year or more pending the development of the new property. During the year, 37,263 tons of ore was mined and treated, yielding from all sources gold worth £81,122. The net profit was £14,662 which was carried forward. The company has over £60,000 in liquid funds available for development purposes. At the Wonderland property, the shaft has been sunk to 190 ft. and a 2nd level opened. On the 1st level the ore-shoot has been proved for 220 ft., averaging 15·3 dwt. gold per ton over 30 in., and the west face is still in ore. The Danga property had been previously worked by tributors, but the ground collapsed, and the company is sinking a new shaft.

Matabele Queen's.—This company was formed in November 1910 as a subsidiary of Willoughby's Consolidated to acquire the Queen's mine in the Bembezi district of Rhodesia, about 28 miles northeast of Bulawayo. The report for the year 1912 has only just been published. This shows that 16,517 tons of ore was treated in the 10 stamps and 2 Wheeler pans, in which gold worth £21,164 was recovered by amalgamation; while 19,396 tons of sand and slime yielded £16,749 by cyanide, making a total gold production of £37,913. The net profit after allowance for depreciation and development was £1699. During the year £21,291 was spent out of capital on shaft-sinking, slime-plant, etc. The Czarina shaft on the western section of the property was sunk to 832 ft. by December 31 and at that point the 7th level commenced. The ore reserve was increased by about 10,000 tons during the year, and stood on December 31 at 31,680 tons. Since then the figures have been again increased, and on August 31 were 40,394 tons averaging 45s. 3d. per ton. The recovery at the new slime-plant is not satisfactory, and the advice of F. A. Marriott has been sought. Mr. Marriott is one of Bewick, Moreing & Co.'s engineers, and he came from Australia to Rhodesia for the purpose of reporting on the metallurgical treatment at the Lilien, Munnah mine. The alterations recommended by him for the Queen's involve

the expenditure of £22,000, but the company is not able at present to raise this amount of new capital.

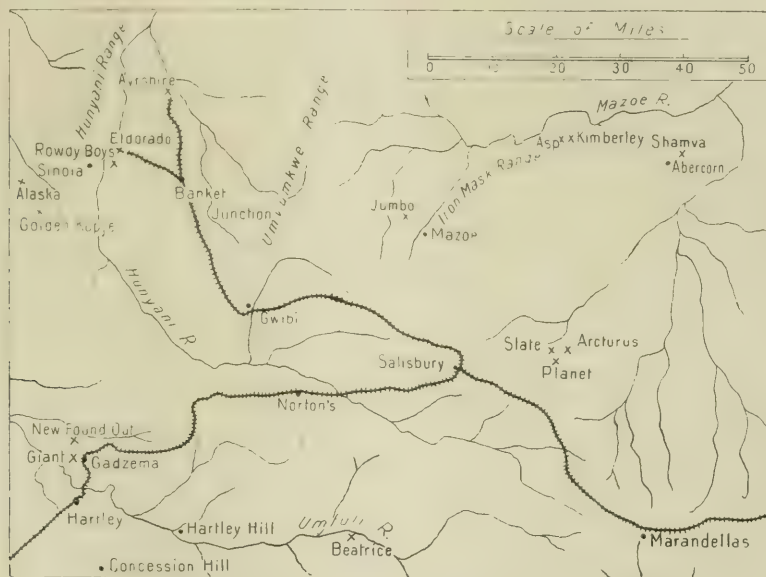
Bechuanaland Copper.—This company belongs to the Edmund Davis group, and was promoted in 1909 by the Bechuanaland Exploration Co., to acquire the Bushman copper deposits, in Khama's Land, 120 miles southwest of Bulawayo. The issued capital is £75,244 in shares of 10s. each. The shares offered to the public were underwritten by L. Hirsch & Co. B. F. McDowell is manager, and A. J. Fraser is consulting engineer. Recently, S. J. Speak made an examination. The report now issued covering the year ended May 31 last shows that prospecting and development work has been suspended, and that the total of 10,138 ft. done since the beginning has not disclosed sufficient ore to make it possible to say that the results have been a success. Though the lode has been proved to be extensive, the copper content is generally low, and the rich lenses are limited. The amount of ore exposed is about 30,000 tons averaging 8% copper. It is proposed to establish a Siemens-Halske plant to treat this. The ore would be dry-crushed, roasted, leached with sulphuric acid, and electrolysed. The cost of an installation with a capacity of 20 to 25 tons per day is estimated at £20,000, and the period occupied in treating the present reserve would be 4 years. The electric current would be generated by a wood-gas producer. It is stated that the sulphuric acid is regenerated, and that the small losses would be made up by the sulphate produced in the roasting. The cost of producing the copper is estimated at £30 per ton.

Giant Mines of Rhodesia.—This company was formed in 1903 to acquire from the Enterprise Gold Mining & Estates a partly developed gold mine in the Gadzema district of Rhodesia. The position of the mine is shown on the accompanying map. The control is with the London & Rhodesia Mining & Land company, of which Julius Weil is chairman. The mine was highly profitable for several years, but two years ago the lode was lost on the 7th level owing to faulting, and in spite of extensive borings and advice on geological structure from G. S. Corstorphine, no further discovery of ore has been made. Milling commenced in 1906 and dividends were paid from the start. From the beginning of operations to the end of June 1913 the amount of ore milled was 669,207 tons, from which gold worth £1,050,616 was extracted. The dividends during this time totalled £364,409. The issued capital of the company is £262,090, of which £100,000 in shares and £20,000 in cash was purchase price, £85,000 was subscribed in cash by shareholders in the promoting company, and £12,090 issued to the holders of £48,360 debentures created in 1908, the exchange being made at the rate of £4 per share for £1 debentures. The report for the year ended June 30 shows that 131,887 tons of ore was milled, and 42,556 oz. gold recovered, worth £179,928, as compared with 134,209 tons, 52,116 oz. and £221,404 the year before. The net profit, after allowance for taxes and depreciation, was £75,645. The sum of £77,125 has been distributed as dividend, being at the rate of 30%. The ore reserve on June 30, 1913, is not given. The report states that on June 30, 1912, the reserve was 243,687 tons averaging 8·2 dwt. gold per ton, and that during the year to June 30, 1913, the amount of ore mined was 131,887 tons averaging 6·45 dwt. per ton. In January last some of the pillars left in the north end of the mine collapsed, but subsequent investigation shows that most of the ore will be recovered, though, being mixed with rock, it will be reduced in grade. Diamond-drilling is being done on the Giant South with results

that are fairly promising. The report contains information relating to the option on part of the Cam & Motor property, particulars of which were given in our last issue. In assessing the actual returns to shareholders in the Giant it will be seen that the distribution of dividends is hardly sufficient to repay holders of shares at £1 each. A large proportion of the shares issued at £1 went to the vendors. In 1909 and 1910 the buyers of shares paid anything up to £6 per £1 share, and the debenture holders exchanged into £1 shares at £4 each. The present quotation of the shares is about 14 shillings.

Jumbo Gold.—This company was formed in 1906 by the United Rhodesia Gold Fields, one of the Lewis & Marks group, to acquire a gold mine in the Mazoe valley, north of Salisbury, Rhodesia. Operations started in 1906, and from then until September 30

Planet-Arcturus Gold Mines.—This company was formed in October 1911 to acquire a group of partly developed properties, twenty miles to the east of Salisbury, Rhodesia. The promoters were the Rhodesian Exploration & Development company and the City Agency & Investment company, the latter being a syndicate connected with the former Goldfields of Matabeleland. The control of the Planet-Arcturus passed last year to the Gold Fields Rhodesian Development company. Three properties are being developed, the Slate, Planet, and Arcturus, as shown on the accompanying map. The report now issued covers the fourteen months ended December 31 last. It gives details of the development work at the three mines, at all of which the reserve has been substantially increased. On December 31 the figures were: At the Slate, 87,809 tons averaging 16.5 dwt. per ton; Arc-



THE DISTRICT ROUND SALISBURY, RHODESIA.

last the total yield of gold has been 123,393 oz. from 243,577 tons of ore. A year ago it was announced that the orebodies were rapidly nearing exhaustion, and development was discontinued. In March of this year it was resumed, and a small amount of additional ore was disclosed. The report for the year ended June 30 last shows that 37,180 tons of ore was raised averaging 8.4 dwt. per ton, and 13,603 oz. extracted by amalgamation and cyanide, being a recovery of 85%. The income from the sale of gold was £57,830, and the working cost was £41,145, to which must be added £11,877 allowed for depreciation, £18,590 for development redemption, and £1836 London expenses. The loss for the year was £17,350. During the year £16,000 debentures have been redeemed. Cyril E. Parsons, the consulting engineer, states that there is no hope for discoveries at depth, but that various parts of the mine may continue to yield small amounts of ore for some time; and there may be a chance of finding parallel lodes. As the mine has continued in existence for a longer period than was anticipated a year ago, Mr. Parsons is sanguine that further efforts are well worth while.

Arcturus, 106,566 tons averaging 11.7 dwt.; Planet, 12,485 tons averaging 14 dwt. Since the termination of the year operations were suspended pending the provision of further funds. A scheme for raising additional capital will be placed before shareholders shortly. A railway is to be built to connect with the Mashonaland Railway system. Plans are in hand for the erection of metallurgical plant. W. H. F. Dudgeon is the consulting engineer.

Amalgamated Zinc (De Bavay's).—This company works the De Bavay flotation process at Broken Hill and treats the zinc tailing produced at the North, South, and Block 10 mines. Two years ago it acquired the Potter patents, and thereby was enabled to effect a consolidation of patent interests with the Minerals Separation company. The result of these negotiations was that a new company was formed called the Minerals Separation and De Bavay's Processes Australia Proprietary, Limited, to hold the combined patents in Australia and to receive and distribute the royalties earned by the two processes. The report of the Amalgamated Zinc (De Bavay's) for the half-year ended June 30 shows that 245,064 tons of zinc

tailing was treated, yielding 66,151 tons of zinc concentrate, assaying 49.2% zinc, 5.9% lead, and 8.5 oz. silver per ton, together with 780 tons of lead concentrate assaying 52.5% lead, 17.8% zinc, and 36.2 oz. silver per ton. The operations were impeded by the strike on the Broken Hill railway. The profit for the half-year was £82,486, and £100,000 was declared as dividend, being at the rate of 4s. per £1 share. The profits are calculated on the basis of £22 per ton for zinc.

Great Fitzroy Mines.—We have in previous issues given the history of this company, which was formed in 1907 under the laws of the State of Victoria to acquire a gold-copper mine at Mount Chalmers, to the north of Rockhampton, Queensland. Bewick, Moreing & Co. are the general managers. There have been two constructions, one in 1908 and the other in 1912. During the year ended May 31, 107,098 tons of ore was raised, of which 34,887 tons of pyritic ore averaging 2.88% copper and 2.83 dwt. gold per ton was sent direct to the smelter, and 71,847 tons of silicious ore averaging 2.62% copper and 2.12 dwt. gold was sent to the concentrating plant. The production of concentrate amounted to 14,445 tons averaging 10.96% copper and 8.29 dwt. gold, being a recovery of 84% of the copper and 78% of the gold. The smelting plant produced blister copper containing 2235 tons copper, 11,356 oz. gold, and 33,088 oz. silver. The income from the sale of these products was £201,467 and the net profit was £549. The issued capital of the company is £99,531, and there is a debenture debt of £66,900, part of which is held by the Australian Metal Company. The report states that the concentrating plant, operating the Minerals Separation process, has been gradually improved and the recovery increased. An option has been acquired on the Laloki mine in British New Guinea, 17 miles from Port Moresby. G. C. Klug and John Adam, the consulting engineer and mine manager, have examined this property, and P. R. Osborne has been put in charge. The development is being actively prosecuted. The ore is pyritic, containing 3 to 4% copper and about 2 dwt. gold per ton. It should form an admirable mixture with the silicious ore at the Great Fitzroy.

Botallack.—As recorded in previous issues, this company was formed in 1906 by the Allen-Meyerstein group to reopen the old Botallack tin mine north of Land's End, Cornwall. Developments proved disappointing and on several occasions additional capital was subscribed. In 1911 it became necessary to reconstruct and assess the shareholders. Since then two sets of debentures have been created, the first in March 1912 and the second two months ago. The capital of the company is £98,271; there are £25,550 debentures issued 18 months ago, and £6100 issued 2 months ago. Pettit & Poore are the consulting engineers, and Merricks, Crane & Co. are the managers. The report now issued covers the year ended June 30 last. It shows that a large amount of systematic development work has been done, the footage being no less than 5150 ft. The Botallack shaft has been unwatered and timbered to the old 1230-ft. level, and Allen's shaft has been sunk to 1477 ft. In spite of all this work, very little profitable ore has been disclosed, and the 9th and 10th levels have proved disappointing. During the year, the 20-stamp mill has been fully employed, treating 11,980 tons of ore from the mine, and 13,308 tons from the dump, a total of 25,288 tons. The output of tin concentrate was 131 tons or 11½ lb. black tin per ton. This sold for £17,572, while the cost at the mine was £18,377. In addition, London expenses absorbed £1903, and £1208 was due on de-

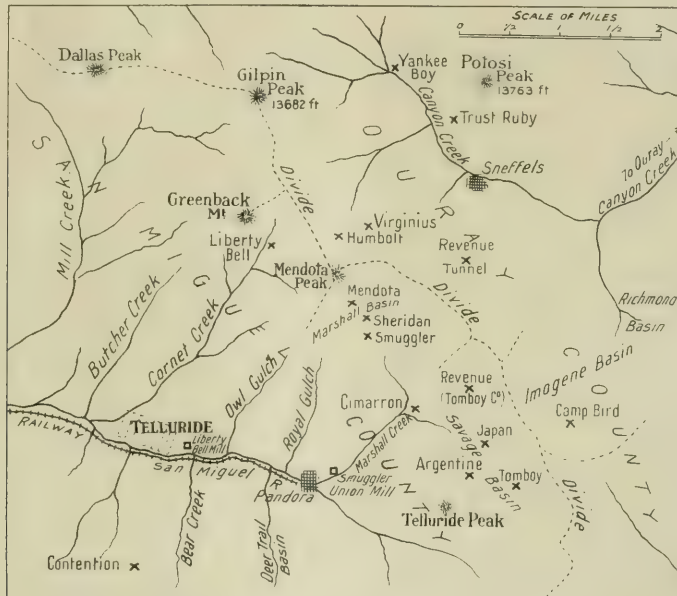
benture interest. During the year, much study has been given to the extraction problem, and efforts have been made to increase the percentage of recovery. Trials were made with the volatilization process, but without satisfactory results. Since then, additional slime-plant has been erected. Ten of the other 20 stamps that have been on the property since 1907 have been put into commission since the close of the year under review, making 30 in all, with the object of reducing the cost per ton.

Caucasus Copper.—We have on several previous occasions recapitulated the history of this company, which was formed in 1900 to acquire large deposits of low-grade copper ore at Dzansul in the Russian Caucasus. A large proportion of capital was provided by the Pierpont Morgan group. Many abortive attempts at smelting and concentration were made, and it was not until W. R. Van Liew, of Montana, was made manager and James Colquhoun, once of the Arizona Copper company, was added to the board that mining and metallurgical efficiency was secured. Two serious disadvantages still handicap the work of these engineers. One is the severity and uncertainty of the winter weather, and the other is the tremendous weight of capital and debt under which the company groans. The report for the year ended May 31 last (Russian style) shows that a third unit of concentration plant with a capacity of 250 tons per day was completed early this year, but it is not working to its full capacity as the new aerial ropeway is not yet in operation. It is expected that this ropeway, which has a capacity of 2000 tons per day, will be at work before many weeks have elapsed. A fourth unit of 250 tons is in course of construction, bringing the total capacity of the concentration plant to 1000 tons per day. The output of copper during the year was 2992 metric tons, and the copper sales brought an income of £269,070. The working profit was £87,858, out of which £70,066 was paid as interest on debentures and loans. In addition, £41,127 was written off for depreciation of plant, so that the loss for the year was £23,335. Severe snowstorms during December, January, and February interfered with mining operations, and the Balkan war drew away many of the best miners, necessitating the employment of unskilled drillers. The removal of overburden by hydraulic mining is being continued, and the use of the 'mill-hole' system of mining is being extended. A new oil-fired reverberatory furnace was started in September last year, and has greatly reduced the consumption of crude oil.

Central Chili Copper.—This company was formed in 1894 to continue the work of the Panulcillo Copper Co., which originally started operations in 1864. The mines are near the port of Coquimbo, 100 miles north of Valparaiso. The issued capital is £312,468 and small dividends have been paid in 1896, 1900, 1901, and 1907. The old Panulcillo company paid dividends during three short periods, but on the whole was not a profitable proposition. A large proportion of the shareholders are resident in France, and the reports are published in the English and French languages. Eugene A. J. Goldschmid is chairman of the company, and B. C. Hinman is managing director. Berthold Schiff succeeded the late H. M. McLaughlin as manager in July 1912. The report now issued covers the year 1912. Owing to the higher average price of copper, £73, as compared with £56 during 1911, a profit has made instead of a loss, and more custom ore has been available from mines that had to close during the period of low prices. The adverse circumstances in connection with railway facilities still pre-

vent the expansion of mining in the district, and tend to keep the costs high. During the year, 25,066 tons of ore was raised from the company's mines, the Panulcillo supplying practically the whole of it. At the smelter 34,053 tons of the company's ore was treated, averaging 3½% copper, together with 20,945 tons of custom ore averaging 8% copper. From this, 5333 tons of matte was produced, containing 2439 tons of copper, 44,348 oz. silver, and 1140 oz. gold. The income from the sale of the matte was £195,672, from which must be deducted £30,589 for smelters' charges and freight. The cost of mining was £16,985, and smelting at Panulcillo £43,247, and £67,952 was paid in the purchase of custom ore. The profit in South America was £22,124. The London and administration expenses were £3535, and £4352 was written off

The results of development on the Montana have been on the whole satisfactory. While some parts that were considered promising have given disappointing results, owing to the lodes disappearing or the ground becoming broken, other discoveries have been made that more than compensate. D. A. Herron, the manager, hesitates to give a definite figure for the ore reserve at the Montana, owing to the undependability of any estimate of the content of the ore even when blocked-out on four sides. He quotes a round figure of 100,000 tons as reserve on June 30, to which is added 62,000 tons broken in the stopes. The ore reserve in the Argentine is estimated at 64,000 tons, to which must be added 200,000 tons broken in the stopes. During the year, 129,618 tons of ore was sent to the mill. Of this, approximately 76,000 tons came from



PART OF COLORADO, SHOWING THE TOMBOY PROPERTIES.

for depreciation and the extra exploration account. The year began with an adverse balance of £10,154 and ended with a balance in hand of £4216. Much less development work was done during the year, chiefly on account of scarcity of labour. A diamond-drilling outfit has been ordered.

Tomboy Gold Mines.—This company was floated by the Exploration Company in 1899 to purchase a gold mine of that name in the Rocky Mountains, above Telluride, Colorado. In 1901, on the approaching exhaustion of the mine, the Argentine property near-by was acquired. Two years ago, a further purchase of property was made, the Montana group, constituting the southern portion of the Revenue Tunnel company's claims, being bought for £80,000 in cash. The accompanying map shows the position of the mines in relation to others in the district, of which the Camp Bird is of chief interest in this country. The report for the year ended June 30 last shows that the greater part of the development work has been done on the Montana, and that the ore reserve on the Argentine has been decreased. A year ago it was announced that the lower levels of the Argentine were to be prospected. This work has been postponed for the time.

the Argentine and 54,000 tons from the Montana. The bullion saved by amalgamation was worth \$358,732, and the concentrate sold for \$681,625. The working cost was \$569,011. In the accounts, the realized profit is given at £96,066. Out of this, £54,250 has been distributed as dividend, being at the rate of 17½ per cent. The ore from the Montana is reported as containing 9.6 dwt. gold and 4.5 oz. silver per ton, 1.03% lead, 2.18% zinc, and 0.28% copper. The concentrating plant is an elaborate one and was designed by Gelasio Caetani.

Consolidated Main Reef.—This company was formed in 1896 to acquire gold-mining properties in the middle west Rand, owned by the Main Reef and Consolidated Angle-Tharsis, two companies that were formed in 1888 and 1893 respectively. The control is with the Neumann group. Though milling was started in 1888, no divisible profit was made until 1907, and during this long period operations were suspended several times. During the year ended June 30 last, the amount of ore raised was 307,814 tons, and after the rejection of 13½% waste, 266,715 tons was sent to the mill, which contains 120 stamps and 3 tube-mills. The yield by amalgamation was 74,836 oz. and by

cyanide 22,247 oz., or a total of 97,083 oz., being 7·3 dwt. per ton milled. The revenue from the sale of gold was £407,255, or 30s. 7d. per ton milled. The working cost was £267,840, or 20s. 1d. per ton milled. In addition, £86,667 was spent on capital account on shaft-sinking and plant. The shareholders received £92,436 as dividends, being at the rate of 10% for the year. The results compare favourably with those for the previous year. The amount of ore milled was 23,639 tons greater, and the yield of gold was £57,000 greater. The yield per ton was 1s. 8d. higher at 30s. 7d., and the 'working cost' per ton lower by 1s., at 20s. 1d. The development work during the year has expended 185,050 tons of ore, averaging 7·2 dwt. gold per ton over a stoping width of 48 in. The ore reserve on June 30 was estimated at 614,470 tons, averaging 7½ dwt. over an estimated width of 48 in. As already recorded in our columns, the new vertical shaft cut the lode at 2365 ft. S. C. Thomson has resigned as consulting engineer, and David Wilkinson has been appointed to the position. J. E. Healey has been manager since the retirement of C. H. Spencer in January last.

Main Reef West.—This company belongs to the Neumann group, and has the same manager as the Consolidated Main Reef, mentioned in the preceding paragraph. The company was registered in 1899, but it was not until 1909 that milling was started, when an 80-stamp mill was erected. Since then 40 more stamps and 3 tube-mills have been added. The issued capital is £491,188 in £1 shares, of which 391,188 were issued to the vendors as fully paid, and 100,000 were subscribed in cash at £2 each. There are also £300,000 debentures which were issued at par in 1909. The first dividend was paid in 1910. During the year ended June 30 last, the amount of ore mined was 266,599 tons, and after the rejection of 13% waste, 232,058 tons was sent to the mill. The yield of gold by amalgamation was 60,058 oz., and by cyanide 23,180 oz., making a total of 83,238 oz., worth £349,178, or 30s. 1d. per ton milled. The working cost was £258,656, or 22s. 3d. per ton, leaving a working profit of £90,522, or 7s. 10d. per ton. On capital account, £42,465 was spent on shaft-sinking and plant. Taxes absorbed £9913, and debenture interest £17,625. In addition, £18,750 was allocated to the redemption of debentures. The shareholders received £24,559, the dividend being at the rate of 5%. The tonnage milled was 46,207 tons greater than during the previous year, but the yield was 3s. per ton less, and the working cost rose by 5d. per ton. The development work has not given satisfactory results. The west section has been disappointing, for most of the ground developed contains ore below the pay-limit. The reserve on June 30 was estimated at 591,830 tons, averaging 6 dwt., a fall of 93,890 tons as compared with the figure a year ago, and the average content also showed a slight decrease. Owing to these poor results, attention is being given to the rapid opening of the deeper levels.

Messina (Transvaal) Development.—This company was formed at the beginning of 1905 to acquire a copper property consisting of ancient mine-workings in the north of the Transvaal near the Rhodesian border, and 130 miles from Pietersburg. A. M. Grenfell is chairman; R. J. Frecheville is on the board, J. M. Calderwood is consulting engineer, and J. Allan Woodburn is manager. A description of the mine by Mr. Woodburn appears in the 'Précis of Technology' this month, and a statement of the general position was given in our issue of December last. The report now issued covers the year ended June 30. Shaft No 5 is being sunk to 1000 ft. as a second main shaft, and is

down 678 ft. on June 30. When it is completed it will be possible to raise 10,000 tons of ore per month. The new concentration plant is nearly complete, and two reverberatory furnaces have been erected, one being put into commission at the end of July and the other being now ready to start. The railway connecting with Pietersburg and Pretoria is to be ready before the end of the year, and arrangements have been made for the completion of communication from Bandolier Kop to Tzaneen on the Selati railway, which will give access to Delagoa Bay. The distance to the sea by the latter route will be 431 miles, as compared with 697 miles through Pretoria to Cape Town. The ore reserve is calculated at 230,000 tons averaging 10% copper blocked out; in addition 148,000 tons is probable ore partly exposed and blocked out, and 100,000 tons is possible ore down to the 10th level. The coal mine four miles away is being actively developed, and the coal is mixed with supplies drawn from the Middelburg coalfield. At the present time the reverberatory furnace is treating accumulated middling which contains from 10 to 15% copper. It is proved that the ore is practically self-fluxing and can be treated in these furnaces with the addition of a small amount of limestone. During the year under review, 22,601 tons of ore, assaying 10·14% copper, was mined and sent to the concentration plant, where 3602 tons of concentrate was recovered assaying 45·8% copper, together with 2591 tons of middling assaying 11·16% copper. The shipments of concentrate to Swansea during the year aggregated 3462 tons, and the net receipts were £93,786. The profit was £29,734, out of which £15,000 was paid as debenture interest, and £1689 as profits tax. It should be recorded that the manager of the smelting department is T. D. Nicholls, who was for many years metallurgist to the Cape Copper company at Britonferry, South Wales.

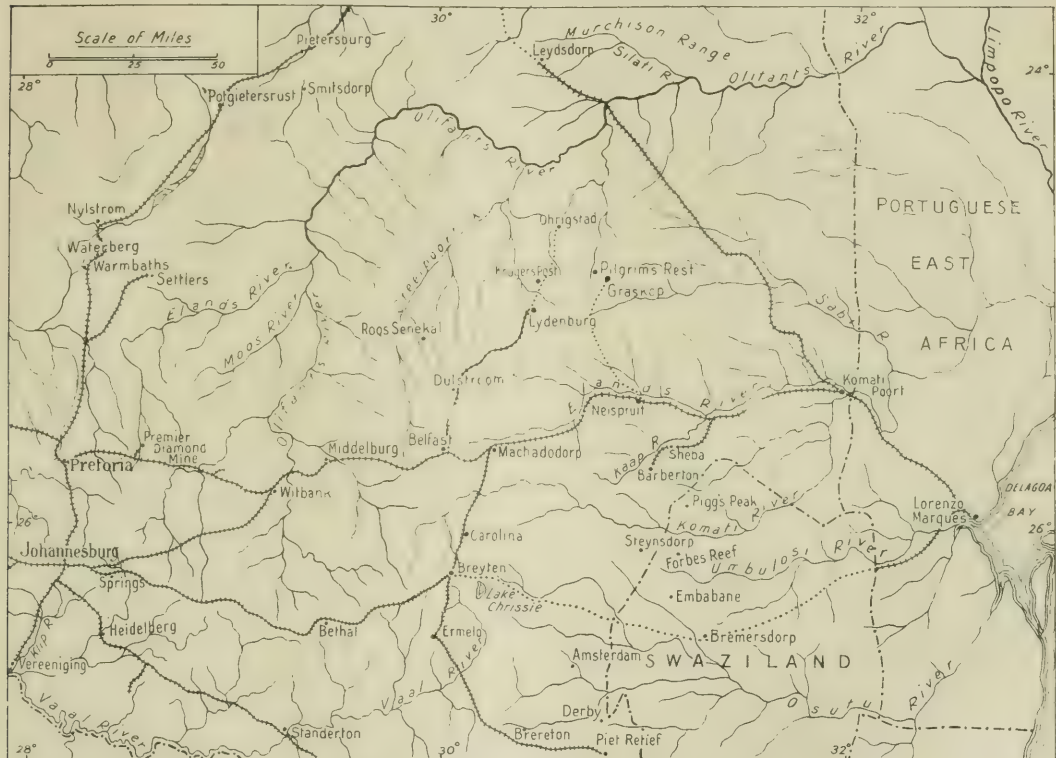
Sheba Gold.—This company was formed in 1884 to acquire a group of gold-mining properties in the Barberton district of the Transvaal. Dividends were paid from 1891 to 1898, but subsequently there came a series of disappointing years. In 1904 the company was reconstructed and in 1911 the capital was reduced by the nominal value of the share being altered from £1 to 5s. Four years ago it was decided to alter the method of working the properties, and to concentrate operations on one or two instead of drawing ore from many different mines. The results of the new policy have been gratifying, for the Zwartkopje mine has given excellent returns and dividends are again being paid. The report for the year ended June 30 shows that 68,920 tons of ore was raised, 66,860 tons coming from the Zwartkopje. The average content was 13·2 dwt. per ton. During the previous year 68,865 tons of ore averaging 12·2 dwt. per ton was raised. The yield of gold was 37,888 oz., worth together with the silver £160,328, being a recovery of 83·3%. The profit at the mine was £55,532, out of which £6299 was paid as profits tax, £2387 allowed for depreciation, and £4565 written off the cost of development of the Rosetta property. The dividends absorbed £47,204, being at the rate of 17½%, as compared with 15% the year before. Development work has been impeded during the year by shortness of labour-supply, and the reserves have not been fully maintained. At the Zwartkopje, the reserve was calculated on June 30 at 70,000 tons averaging 12 to 15 dwt. per ton, at the Insimbi 15,000 tons averaging 7 to 8 dwt., at the Intombi 20,000 tons averaging 10 dwt., and at the Southern Cross 5000 tons averaging 10 to 12 dwt. The developments have however given promising results, for the ground below the 7th level has at several

points been proved to contain orebodies of high content. The Rosetta property has been a disappointment, and development work has been suspended. George C. Fox is consulting engineer, H. B. White is manager, and the control is with Lewis & Marks.

Glynn's Lydenburg.—This company was formed in 1895 to acquire a gold mine on the Sabie river, near Pilgrim's Rest, in the Lydenburg district of the Transvaal. Milling commenced in 1897 with 10 stamps and profits have been made continuously. The metallurgical plant now consists of 20 stamps and 1 tube-mill. The control is with the Central Mining group, and G. C. Damant is manager. After many years of

of 20%. For the previous 7 years the dividend had been at the rate of 25 per cent.

Swaziland Tin.—This company was formed in 1905 under Transvaal laws to acquire tin-gravel properties at Embabane in Swaziland. The control is with the Central Mining group. As far as we are aware no shares are held in England. The issued capital is £82,000, and the yearly dividends have ranged from 5 to 25%, commencing in 1906. The yearly output of tin concentrate has varied from 229 to 511 tons. J. Jervis Garrard is consulting engineer, and T. Kelly is manager. The report for the year ended June 30 last shows that 408,349 cubic yards of gravel was treated



EASTERN PORTION OF THE TRANSVAAL.

steady prosperity, the company is having to face a threatened exhaustion of the orebodies. S. Aimetti, the manager of the Transvaal Gold Mining Estates, owning neighbouring property under the same control, has made a special examination in conjunction with Mr. Damant, and has indicated the lines on which future prospecting and development should be done. There may possibly be two years supply of ore in hand, but as it is not distributed uniformly, an estimate of the extent and content is impossible. During the year ended July 31, the period covered by the report now issued, 40,642 tons of ore was mined and sent to the mill, where 6343 oz. gold was recovered by amalgamation, and 14,363 oz. by cyanide; making a total of 20,706 oz., worth £86,556, being 10.2 dwt. or 42s. 7d. per ton milled. These figures compare with 37,325 tons and 20,839 oz. the year before. The working cost was £48,340, or 29s. 9d. per ton, and the working profit was £38,216, or 18s. 10d. per ton. The sum of £34,000 was distributed as dividend, being at the rate

for a yield of 334 tons of black tin, or 1.83 lb. per cubic yard. The black tin averaged 71½% metallic content. The income was £46,307, and the profit was £24,809, out of which £7408 was spent on capital account, and £20,500 was distributed as dividend, being at the rate of 25%. In the prospecting done by Empire drill during the year, 1235 boreholes have been sunk. The reserve of gravel consists of 1,958,051 cubic yards averaging 1.53 lb. metallic tin per yard. In addition there is a probable reserve of 10 million cubic yards. During the year a change of method has been adopted, gravel pumps being substituted for hydraulic elevators, and electric power obtained from the waterfalls. The water formerly employed in the elevators is now being used in additional monitors.

Pusing Bharu Tin Mines.—This company belongs to a group owning alluvial tin mines at Pusing in the state of Perak, Federated Malay States, under the control of W. A. Luning as chairman and A. Pavne-Gallwey as general manager. The company was formed

in 1907, and in 1909 an electric-power installation was built conjointly with the Siputeh company. The deposit contains much clay and puddling is necessary. The issued share-capital is £80,000. Dividends were first paid in 1910, and the total distribution so far is 32½%. The report for the year 1912 shows that the production of tin concentrate was 311 tons, selling for £37,534, or £120 per ton. In addition, £2382 was received as tribute from Chinese workers, and other items brought the revenue to £40,319. The expense at the mine was £29,894, and London expenses and allowance for depreciation brought the cost to £33,284, leaving a profit of £7035. Out of this, £6000 has been distributed as dividend and £1000 placed to reserve. At the beginning of the present year it was decided that the method of work adopted by the company was not suitable to the nature of the deposit, and since May the property has been let on tribute. During the four months May to August inclusive, the tributors won 85½ tons of concentrate, yielding a profit to the company of £2021. Other tin-lands have recently been inspected, and a prospecting license in connection with a property unnamed has been acquired. The expense of testing and development is being shared with the other companies belonging to the group.

Malayan Tin Dredging.—This company was formed in May 1911 to acquire tin-gravel properties near Batu Gajah, in the Kinta district of Perak, Federated Malay States. The report on the property was made by Nutter & Pearce, of Ipoh, Perak, and F. W. Payne & Co. are the designers of the dredging plant. Leonard Vaughan is manager. The report for the year ended June 30 last shows that the first dredge started work on January 1, and during the six months treated 260,000 cu. yd. of ground, for a yield of 112½ tons of cassiterite concentrate assaying 72% metal. The recovery was just under 1 lb. of concentrate per cu. yd. The ground was mostly taken from shallow depth, and the parts below have a higher content. In fact the work done has been in the nature of development required for preparing a suitable working face. The results were so far satisfactory that the directors proceeded to order two more dredges. One is now being erected on the spot, and the parts of the other are being assembled in London. For the purpose of raising the necessary funds 10,000 shares were subscribed at £3. 15s. 0d. each. The nominal issued capital now stands at £110,000. The accounts for the year show an income of £14,282 from the sale of the concentrate, and a net profit of £8045, out of which £5500 has been distributed as dividend, being at the rate of 5 per cent.

Tingha Consolidated Tin Mines.—This company was formed in Melbourne in 1906 to acquire tin-gravel properties at Tingha, New South Wales. James Symes is manager. During the half-year ended July 31, four pump-dredges were at work, and 71 tons of cassiterite was recovered, selling for £9427. The cost was £7090, and £2500 was distributed as dividend on a capital of £200,000. The plant has been kept in an excellent state of repair. The tin content of the alluvium varies greatly. Bore-holes ahead of the present working faces promise an improved and more regular output. Additional properties are being examined.

Scottish Australian Mining.—This company was formed as long ago as 1859, for the purpose of working a number of properties in Queensland and New South Wales, belonging to the Scottish Australian Investment Co. Dividends have been paid continuously since 1869. Operations have been centred for many years on the Lambton and Burwood collieries, near Newcastle, New South Wales. The company also

owns the Cadia copper and iron mines, near Lithgow, New South Wales, which are let on lease. The report for the half-year ended June 30 last shows that 128,996 tons of coal was sold. The demand has been good, but the scarcity of labour has prevented the mines being worked to their capacity. The labour situation is uncertain. Wages go up, and on occasions stoppages have occurred that cannot be dignified by the name of strikes. At the Cadia copper mine, the new blast-furnace has been working intermittently. The iron ores remain undeveloped. The receipts from the sale of coal amounted to £62,573, and the net profit was £7636, out of which £5000 has been paid as dividend, being 2% for the half-year.

Asgard.—This company owns the Mount Roudny gold mine at Zvestov, Bohemia. The property was originally introduced in England in 1903, when it was floated by the Mount Roudny Gold Mines Co., but in 1909 the debenture holders foreclosed and their trustee sold it. The capital of the present company is £20,000, and dividends have been paid continuously. The report for the year ended June 30 last shows that 32,125 tons of ore was treated for a yield of 6997 oz. by amalgamation, 242 oz. by cyanide, and 1882 oz. by concentration, making a total of 9121 oz. gold, which, together with a small amount of silver, sold for £39,440. Dividends absorbing £7500 have been distributed. J. Hoffmann, the manager, reports that 5500 ft. of development work has been done during the year, and that the reserve stands at 126,620 tons, averaging slightly over 8 dwt. per ton. The content and width of the veins vary considerably, and much unprofitable ground is encountered. The developments in the deepest level, at 970 ft., are decidedly encouraging.

Aramayo Francke Mines.—This company was formed in 1906 to acquire the tin, wolfram, and bismuth mines in Bolivia belonging to Aramayo Francke & Co. In 1908 additional mines were purchased at Chorolque. The district in which the properties are situated is in the south of Bolivia, between Potosi and Tupiza. Particulars relating to them were given in an illustrated article published in our issue of March 1911, in which the new tin-dressing plant was described. The properties consist of the mountain of Chorolque containing deposits of tin, bismuth, and wolfram, concentration plants at Santa Barbara, Santa Elena, and Sala-Sala, mines at Cotani, smelting works at Quechisla, mines at Tasna with smelting works at Buen-Retiro, tin and silver mines at Chocaya with concentration plant at Asllana, and others. At one of the smelters, copper is being produced, and according to monthly circulars the output is about 20 tons per month. The report for the year ended May 31 last gives scant information, and no figures for production are published. It is merely stated that the sales have been less, but the prices higher, these variations balancing each other and resulting in the profit being much the same as the year before. The sales a year ago were about 4000 tons of tin concentrate and 50 tons of wolfram. During the past year, the profit in Bolivia was £153,177, and interest brought the net income to £157,498. Out of this, £4531 was paid as income tax, £3,750 as debenture interest, £10,000 applied to redemption of debentures, and £2202 as London expenses, leaving a balance of £137,015, to which is added £45,359 brought forward from the previous year, making £182,374. It is proposed to place £66,000 to reserve, and £104,404 has been distributed as dividend, being at the rate of 17½%. The issued capital is £596,590, and there are £70,000 debentures extant.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	Sept. 30 Tons	Oct. 31 Tons	Nov. 30 Tons
In England	15,134	13,278	11,993
In France	2,715	2,972	2,487
Afloat from Chile	1,225	1,350	2,050
Afloat from Australia	3,450	3,750	4,950
In Rotterdam	2,700	2,400	2,500
In Hamburg	1,121	1,079	1,785
In Bremen	1,475	998	992
In other European Ports..	1,100	1,550	1,030
Total European visible supply	28,919	27,377	27,787

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Production.	Deliveries			Stocks at end of month
		Domestic	Foreign	Total	
Total, 1911.....	639,258	316,791	337,009	653,800	—
Total, 1912.....	706,052	365,920	333,212	699,132	—
January	64,053	29,111	26,956	56,067	55,000
February	58,460	26,641	32,219	58,860	54,600
March	60,822	34,190	34,682	68,872	46,550
April	60,416	34,892	38,346	73,238	33,728
May	63,088	36,209	30,477	66,686	30,130
June	54,402	30,559	30,396	60,955	23,577
July	61,640	26,296	35,035	61,331	23,886
August	58,764	32,897	32,706	65,603	17,064
September	58,661	29,837	32,627	62,464	13,261
October	62,035	30,435	30,412	60,847	14,499
November	59,860	21,721	31,280	53,001	21,358

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
Year 1912	8,753,563	370,731	9,124,299	38,757,560
January 1913.....	760,981	28,409	789,390	3,353,116
February	702,394	31,728	734,122	3,118,352
March	760,324	30,228	790,552	3,358,050
April	755,858	29,116	784,974	3,334,358
May	761,349	32,957	794,306	3,373,998
June	716,267	30,810	747,077	3,173,382
July	625,107	30,282	655,389	2,783,917
August	697,686	30,410	728,096	3,092,754
September	676,411	29,775	706,186	2,999,646
October	687,515	30,916	718,431	3,051,701
November	644,320	29,166	673,486	2,860,788

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
Year 1912.....	25,486,361	29 2	19 3	9 11	12,678,095
January 1913.....	2,296,948	27 8	18 0	9 9	1,113,579
February.....	2,100,137	27 11	18 3	9 9	1,019,774
March	2,321,254	27 5	17 8	9 8	1,121,786
April	2,301,099	27 6	17 11	9 7	1,101,099
May	2,366,726	26 11	17 7	9 4	1,099,397
June	2,177,354	27 6	17 8	9 9	1,061,507
July	1,873,980	27 6	19 4	8 3	785,263
August	2,162,807	27 1	17 7	9 6	1,026,851
September	2,035,318	27 9	17 10	9 10	1,002,228
October	2,073,909	27 6	17 9	9 8	996,515

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mine	Total
January 31, 1913	200,090	8,789	13,912	222,791
February 28,	207,662	8,877	13,918	230,457
March 31	207,733	9,009	15,041	231,783
April 30	205,424	9,053	15,626	230,103
May	197,844	9,062	15,145	222,051
June	188,094	9,060	14,654	211,808
July 31	170,242	9,403	13,378	193,023
August 31	158,223	9,236	14,172	181,631
September 30	152,477	9,361	12,121	174,959
October 31	148,777	9,377	12,712	170,866
November 30	147,777	9,286	12,680	169,743

GOLD OUTPUT OF INDIA.

Year 1911	Year 1912	Nov. 1913	Year 1913
£2,150,050	£2,265,094	£192,606	£2,097,384

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1910	1911	1912	1913
	£	£	£	£
January	227,511	207,903	214,918	220,776
February	203,888	203,055	209,744	208,744
March	228,385	231,947	215,102	257,797
April	228,213	221,296	221,476	241,098
May	224,888	211,413	234,407	242,452
June	214,709	215,347	226,867	241,302
July	195,233	237,516	240,514	249,302
August	191,423	243,712	239,077	250,576
September	178,950	225,777	230,573	250,430
October	234,928	218,862	230,072	247,068
November	240,573	214,040	225,957	—
December	199,500	217,026	218,661	—
Totals.....	2,568,201	2,647,894	2,707,368	2,409,546

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January	15,903	66,107	26,098	107,262	34,857	144,262
February	15,179	63,081	25,009	102,270	32,544	137,038
March	16,387	67,673	27,228	111,376	36,289	150,060
April	17,237	70,880	27,790	114,796	35,295	146,220
May	24,427	96,409	28,015	115,676	34,507	142,617
June	22,555	92,174	27,784	114,697	30,503	125,764
July	22,510	91,955	30,974	127,800	32,345	132,936
August	25,385	103,753	33,015	136,407	30,247	126,090
September	26,717	109,039	34,491	142,397	32,142	132,394
October	26,826	109,503	34,436	142,414	33,270	137,153
November	24,289	99,299	33,183	137,765	—	—
December	24,369	99,569	34,917	144,382	—	—
Totals.....	261,784	1,069,442	362,940	1,497,179	331,999	1,374,534

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
Total, 1911	160,021	1,210,447	1,370,468	5,823,522
Total, 1912	83,589	1,199,080	1,282,669	5,449,057
January to Oct., 1913	73,549	1,010,562	1,084,111	4,606,139
November	9,582	108,330	117,912	500,855

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	Nov. 1913	1913 to date
		£	£	
Victoria	2,138,000	2,039,400	154,500	1,676,200
Queensland	1,623,390	1,484,160	83,200*	934,630*
New South Wales	769,353	702,129	53,849	5,449,057
New Zealand	1,808,049	1,345,115	14,776	1,241,085

*October figures only.

NIGERIAN TIN PRODUCTION.

In tons of concentrate of unspecified content.

Year 1912 tons	October 1913 tons	1913 to date tons
2,532	480	4,108

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911	615½	£702,599	£114 4 5
Year 1912	6492	£831,008	£128 5 6
January to October, 1913	5228½	£647,970	£123 17 6
November 10	250	£25,595	£102 7 7
November 24	248½	£25,827	£103 18 8

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. SIRAUS & Co.

	1912 tons	Nov. 1913 tons	1913 tons
Metal from Straits to Europe and America	59,036	5,590	57,328
Metallic Content from Bolivia to Europe	21,149	2,170	22,718

REVIEW OF MINING

INTRODUCTORY.—Conditions have improved but little since our last issue. Signs of recovery were manifest at the end of November, but the political crises at Paris and Berlin had an adverse effect on the European bourses. Meanwhile the Mexican tangle exhibits no sign of being unravelled, and property in that distressful country is undergoing rapid depreciation. The fear of military intervention by the United States, with all that it may involve, continues to intimidate the money markets of New York and London. Conditions on the Rand are a depressing factor: so are those in Cornwall. A slight revival is shown by the Gold Coast and Nigerian departments; alluvial tin mining in the Malay States offers a cheerful aspect; so does Broken Hill. A state of nervous tension is still discernible, and until it is relieved, by better news from Mexico and by better labour conditions on the Rand, we do not anticipate any decisive improvement in the mining market.

TRANSVAAL.—The production of gold in November decreased 44,945 ounces, equal to £190,913, as compared with October. This is disappointing. It is due to labour shortage. At the end of November the total of natives employed on the gold mines was 147,569, being a decrease of 1312. However, this is the smallest decrease since last April, and affords some promise of a check to further loss, with improvement in the supply as the seasonal migration begins to be felt.

Uneasiness concerning the Brakpan continues, although official statements are of a more encouraging character. During recent months the development has given better results. Officially it is stated that the reduction in the grade of the ore milled is due to an effort to expedite development.

Among pleasant items from the Rand is the good showing being made by the Meyer & Charlton, which is doing better this year than at any time previously. The yield has risen from 42s. 6d. per ton last year to 47s. 1d this year. This company has paid £1,215,309 in dividends. Last year's distribution was at the rate of 60 per cent.

The Van Ryn has an excellent report, having done as well as in 1912, despite the trouble and expense due to the strike. The figures of yield, cost, profit, and reserve exhibit insignificant variation as compared with last year, which was the 21st of active production. Dividends of 45 and 47½%, respectively, have been paid for the last two years. Mr. Leopold Albu estimated the life of the mine at "anything between 15 and 20 years." That was in December 1911.

The Cinderella Consolidated has suspended operations, the reason given being the inability to raise the further capital required. The mine is one of the deepest on the Rand. We refer to the incident on another page.

On November 14 the Randfontein management announced its decision to run the mill for six days per week instead of the full seven. This is explained to be a temporary measure, not to reduce the output but to increase efficiency.

The New Modderfontein is another mine handicapped by labour shortage, for the usual complement of 4013 natives was reduced to 1967 at the end of September. Hence the quarterly report is disappointing. The output has decreased, and, what is even more important, the development work has been heavily curtailed. Ore of higher grade is being treated to compensate for the lessened tonnage.

On November 23 a disturbance among the

natives at the Premier diamond mine was due to two tribes coming into collision. The incipient riot was promptly suppressed by a small detachment of police, and since then all has been quiet.

RHODESIA.—The gold produced in October was worth £247,068, this being a small decrease as compared with the month preceding, but £17,000 better than the corresponding month of last year. The Lonely Reef, Globe & Phoenix, and Willoughby, show slight increases, while the Selukwe Columbia, Jumbo, and Giant show nearly equivalent decreases in production.

Mr. Julius Weil is at Gatooma, to be present at the start of the Cam & Motor mill. Development underground was stopped at the end of 1912, pending the completion of the reduction plant. The Motor mine is credited with a reserve of 913,600 tons, averaging 44s. 6d. per ton. A careful re-sampling is said to have checked this estimate. On the No. 3 level the ore averages 47s. 9d., while on the No. 6 it averages 39s. The official estimate of cost is 23s. per ton, but this is not the total cost, which is likely to be fully 30s. per ton. The treatment of the ore has been a difficult problem and the first results obtained in the new mill are awaited with keen interest.

Meanwhile at the neighbouring mine, the Eileen Alannah, the completion of the mill has been delayed by a change of metallurgical advisors, and the cost of the plant is now found to be £25,000 in excess of the original estimate. This is annoying, but not remarkable. Owing to the state of the money market, it has been decided to extract the money required out of the mine by aid of the old mill, which was run as an experimental plant in 1911.

Improved assays are reported from the No. 10 level of the Lonely Reef, and a winze from the No. 9 level is also said to be going down in good ore.

At the Eldorado the ore reserve has been reduced during the quarter from 74,821 tons of 16'4 dwt. ore to 46,457 tons of 14'1 dwt. ore. The precision of these estimates is ridiculous. The Parallel lode continues unproductive on the 11th level. It has been found necessary to reduce the output further, from 8000 to 4000 tons per month, at the close of the current year.

WEST AFRICA.—The output of gold in October showed a slight increase, due to the extra day, as compared with September. No individual change of production is noteworthy.

The Ashanti Goldfields did not do so well in the year ending on June 30, owing to labour shortage, an accident, and scarcity of fuel. We note that the ore reserve (365,300 tons) is stated in terms of 'extractable value,' and 'profit value' (£573,600), being an evident effort to use intelligible terms. The working cost in West Africa averaged 25s. 11'51d. per ton, and other charges brought the total cost to over 39s. per ton, showing how illusory the 'working cost' can be, unless a full explanation, as in this case, is given. The substitution of gas-engines for steam-power is being completed. The consulting engineer anticipates further obstacles, such as labour shortage, and takes a conservative view of the profit to be earned during the current year, but he regards the general position as much improved.

The Cinnamon Bippo, which was closed down in August 1912, on account of the poor prospects on the 3rd and 4th levels, has been re-opened, in consequence of an arrangement whereby the ore in reserve will be crushed at the Abosso mill. An aerial tramway, 2½ miles long, has been constructed from the mine to this mill, and crushing began on November 1. It is estimated that a supply of 345,000 tons of ore assaying 8½ dwt. is available. This is to be mined and treated at the rate of 6000 tons per month at a cost of 28s. per ton, leaving a profit of 8s. per ton. As to whether

this 'profit' is a net ultimate profit, or a 'working' profit, is not clear.

Mr. J. F. Balfour's report on the Ropp is reasonably cautious. He is quite right in urging the postponement of work on the upper reaches of the streams until the lower parts have been tested, for any other procedure would mean double handling of the tailing. The circular issued by the company is cheerful. An output of 357 tons of tin concentrate, already recovered, is estimated to yield a profit of £26,000, permitting the payment of a 50% dividend. It is expected that the maintenance of the present moderate output of 20 tons of concentrate per month will ensure the continuance of this rate of distribution. An engineer with special knowledge of hydraulicking and dredging is to be sent to the property, with a view to selecting a more comprehensive scheme of operations. It is proposed to delay the shipment of machinery until the railway is open to Bukeru.

The postponement of the Rayfield dividend must have been disappointing, but the chairman, Mr. Oliver Wethered, gave an ample and satisfactory explanation of the causes preventing a distribution of profit at this time. Between 'calabashing' and systematic alluvial mining in Nigeria there comes an interval when the one has been discontinued and the other has not begun. After extracting 506 tons of a 73% tin concentrate by 'calabashing,' that is, by simple panning on the part of natives, the modern plant was expected to be available, but delays due to a congestion of an unfinished railway system prevented a start until October 6, too late to provide funds for a dividend. At present the output is about 45 tons of concentrate per month, from the Rayfield; but a second plant, on the Shen property, has arrived and will be erected forthwith. Two centrifugal pumps are at work on the Top, and a fourth plant is expected to arrive in time for use before the wet season, at the end of May. Mr. J. W.

Iles has estimated that something over 6000 tons of cassiterite are available on the various Rayfield leases; this estimate being based on careful pitting and sampling.

The statement made by Mr. Frank N. Best, the chairman of the Naraguta, must have gratified the shareholders. Allowing for a little reasonable optimism, the speech was an admirable account of the work accomplished. Costs of development and equipment have been met out of revenue, diminishing dividends but placing the business on a substantial basis, and ensuring the eventual cheapening of production. As much as £53,000 worth of tin concentrate is ready for shipment, which will not be delayed now that a system of transport has been organized from the mine to railhead. Three properties already are productive. A profit of £750,000 is estimated to be assured, with a life of 20 years. The output for the present year is to be 900 tons as against 519 last year. The 'leat' (ditch or water-course) and pipe-line are to be completed by June next, that is, in time for use in the wet season. The extension of the Government railway to Bukeru will pass through the Naraguta property, decreasing the cost of transport from £22½ to £18 per ton. But this reduction should not be the last, for the Government has assented to the building of a railway from the coast, at Bonny, through the Udi coalfield, across the Benue river, and linking with the line now under construction from Rahamma to Bukeru. This will shorten the distance from the Bauchi tinfield to the coast by fully 160 miles. Mr. Best sounded a warning note against the growing practice of managers bidding against each other for native labour, the certain effect of which will be to spoil that important market for all concerned. A hearty vote of thanks to Mr. F. O'D. Bourke and his staff was passed, together with a fitting acknowledgment of their devotion to duty. Our own information indicates that the general conditions

on the Naraguta leases are better than is usually the case in Northern Nigeria, the bed-rock and grade being both favourable to effective alluvial mining.

The Jos dredge has started, winning 15 tons of black tin from 5450 cubic yards of gravel in 200 hours of working time. This is at the rate of about 6 lb. per yard. However, it is only an experiment, so far. Significant results should be forthcoming next month.

The Benue dredge handled only 4250 yards, yielding 3 tons 3 cwt. of black tin, or about 2 lb. per yard. Trouble over motors and belting have interrupted the digging. Both dredges are using Diesel engines.

AUSTRALASIA.—The Great Fingall's internal shaft is nearly completed, thus rendering available the extraction of ore developed on the lower levels. This shaft extends from the No. 13 to the No. 18 level, that is, from a vertical depth of 1519 feet to one of 2419 feet. At the last meeting, the chairman, Mr. C. Algernon Moreing, gave the length of the orebody at the No. 17 level as 487 ft., having an average assay-value of 43s. per ton over a width of 52 inches. On the 18th level the drifts have been extended for the full length of ore, namely, about 480 ft., exposing a width and assay-value almost identical with the level above. Two winzes, 100 ft. apart, are going down below the No. 18 level in good ore. At the end of 1912 about 50,000 tons of 40s. ore were estimated below the No. 14 level. Since then this reserve has been considerably increased. The working cost is 22s. and the total cost 25s. per ton.

The Sons of Gwalia is looking well on the 19th level, where 900 ft. of continuous ore has been opened up. This is the greatest single length of stoping ground in the mine; it averages 35s. per ton for 9 feet wide. A winze at 915 ft. south of the shaft, is being sunk in high-grade ore. It will be remembered that the 15th and 16th levels missed the main orebody, which was found later by the

aid of short diamond-drill holes. The south orebody has not been traced below the 18th level, as yet. The mine is 1965 ft. vertical. The working cost is 17s., the total cost being 21s. per ton.

The Broken Hill South Extended, recently reconstructed in a drastic manner, has transferred its property to the Barrier South, Ltd., of which Mr. T. J. Hoover is chairman. Development work will be undertaken. The property adjoins the South Blocks. The west lode has been tested down to about 400 ft., with deeper drill-holes, but the main, or east, lode has never been traced in this company's ground.

At the British Broken Hill the cross-cut on the bottom level, the 11th, which is 1000 feet from the surface, has penetrated good ore. So far 43 feet of ore has been intersected, of which the last 13 ft. averages 11 oz. silver, 16% lead, and 10% zinc.

The Mount Elliott report confirms the correctness of the comment appearing in our September issue. Development on the 5th level has disclosed no more ore, and a winze sunk 100 ft. deeper, with cross-cuts, has found nothing. The ore reserve is given at 44,500 tons assaying from 10 to 12% copper, and it is considered probable that 37,000 tons more of the same grade will be extracted, besides 350,000 tons of 3% sulphide material. Since the date of the report 23,483 tons have been extracted. This compares with a reserve of 85,000 tons of 10 to 12% ore, and 35,000 tons of probable ore of about the same grade a year ago. The directors confirm the statement that negotiations are pending for another property in the district. This property is the Old Cloncurry Freehold, as stated in our last issue.

Misfortune clings to the Great Cobar. Owing to heat and drought, the new dam is empty. In order to conserve water for the water-jackets of the blast-furnaces, it has been found necessary to close down the Chesney mine and mill. On the other hand, we

are pleased to state that the firm of Bewick, Moreing & Co. has been requested to act as managers to the company, with the understanding that Mr. G. C. Klug will take matters in hand. This is a good appointment.

Mr. R. S. Black, the manager of the Kalgurli, made a manly and convincing statement at the annual meeting. Two years' supply of ore and no prospects in depth summarize the position.

Good news comes from the Golden Horse-Shoe, at Kalgoorlie. The No. 4 lode has

The increased gold production of Oroville Dredging, due to the Pato dredge, in Colombia, has enabled the company to arrange for the liquidation of its debt to the Gold Fields and to resume the payment of dividends forthwith, beginning with 10% in the current month. The liabilities to the banks in California have been entirely liquidated. Up to November 25 the Pato dredge has yielded 369,212 cubic yards, from which \$266,267 has been extracted. This is an average of over 72 cents per yard. The local cost is



NOME, AFTER THE STORM.

been cut on the 2780-ft. level, and proves to be 16 ft. wide, assaying 14 dwt. gold per ton. This compares well, both in width and content, with the showing on the level overhead.

The strike in New Zealand prevented the Talisman mill from working more than 8 days in November. That part of the world has suffered severely from labour troubles in 1913. The former Waihi strike has only recently been given an official quietus.

UNITED STATES.—The big storm at Nome, mentioned in our October issue, is reported to have enriched the beach by causing the sea to encroach upon the coastal plain and concentrate the gold therein along the fore-shore. We give a photograph showing the havoc.

given as 10 cents and to it must be added the £3000 per annum allowed for administrative and general expenses, but this only amounts to 1 c. more per yard, so that the margin of profit is exceedingly handsome. The dredge has advanced into the heart of the tested area; so far the yield has been more than twice the estimate (31 c. per yard), and it looks as if an error had been made in the inferences from drilling results. We congratulate the company, and await an explanation from the engineers.

Development work at the Plymouth has been discontinued by the California Exploration Co. pending the extension of the shaft below 1600 feet at an angle that will avoid

the long cross-cuts that would be required if the present vertical shaft were kept in alignment. The showing at 2000 ft. was excellent, exposing 120 ft. of \$14 ore, with the breast in good ore going south, while at 1850 ft. the ore was proved for 334 ft. long. A mill is being designed, to treat 9000 tons per month.

Stratton's Independence shows a profit of £23,735 for the year, permitting the payment of two dividends on the reduced capital of that famous mine. It is apparent that the high-grade ore in the mine has been effectually garnered, and that only low-grade stuff remains, and not much of that, except in the old dumps, which are being so successfully treated by Mr. Philip Argall.

The financial press has contained an account of Mr. A. N. C. Treadgold's statement concerning the prospects of the North-West Corporation. The figures are impressive. They will be understood by reference to the description of methods used in working frozen gravel, appearing in our issues of October and November 1912. It is stated that 7,000,000 cubic yards are to be dredged annually, after having been thawed by exposure in summer, at a cost of 5d. per yard and a yield of 15d. per yard. Eventually the scope of the operations is to be enlarged to 15,000,000 cu. yd. per annum.

CANADA.—Kirkland Lake is coming into prominence. A queer prospectus has contributed. We understand that the area covered by the lake itself is controlled by Rose & Van Cutsem, and that it is proposed to drain it, prior to prospecting the ground. The position of this district is shown in the map on the opposite page. The option on the Keeley mine, in the South Lorrain district, is to be exercised by the Associated Gold Mines of Western Australia. Exploratory work, under the direction of Mr. J. Mackintosh Bell, has been remarkably successful in this case. More recently the same Australian company, through L. Ehrlich & Co., for whom Dr. Bell

acts, has taken an option on the North Thompson property, at Porcupine. This adjoins both the Hollinger and the Crown Porcupine.

The new discovery of rich gold-bearing gravel at Chisana, in Alaska, is said officially to extend into Canadian territory.

MEXICO.—General conditions are no better. The so-called Constitutionalists have captured Juarez, Victoria, Monterey, Culiacan, and Chihuahua. The hero of several of these successes is Pancho Villa, a bricklayer's assistant from Parral, and one of the lowest type of the ruffians now posing as patriots. It is rumoured that he has quarrelled with his chief, Carranza. Meanwhile, Huerta is losing control rapidly, chiefly owing to the exhaustion of his financial resources. Various projects are credited to President Wilson, but we see no way out of chaos except military intervention on the part of the United States.

The Santa Gertrudis and Esperanza officials appear to have contradicted each other as regards the effect of the high rate of exchange. The working cost is lessened because the wages, in pesos, have not changed, while the precious metal produced by the mines has appreciated 25%, as measured in pesos. This last is due, of course, to the rise in exchange. On the other hand, when shipping gold bullion (not silver), an export tax of 10% is now levied by the Government. The Esperanza's output is practically all gold; the Santa Gertrudis yields silver predominantly. We cannot understand the Esperanza statement that the cost of supplies has increased the expense of operation, for the labour item is about 60% of the total cost, and must far outweigh any increase in the cost of supplies now purchased. However, we are dealing with fluid conditions, amid which assets cease to be liquid. The Santa Gertrudis now has an adequate labour supply, which is "the best that has obtained for years." Evidently the revolution has not hurt Pachuca, or El Oro, as it has Chihuahua, for example.

The statements made at the Santa Gertrudis meeting confirm the fact that the estimates of ore between the 19th and 18th levels were incorrectly optimistic, for reasons technically admissible. Work on the 20th level so far points to a further impoverishment. We note the favourable outcome of the *aviado* litigation, this having been finally settled by a Supreme Court decision, giving the company clear title. Although the developments in depth on the main lode are decidedly unfavourable, it is equally important to note the satisfactory evidence of sundry other ore-bearing veins within the company's property. A later cablegram announces the exposure of 21 ft. of \$47 ore on a subsidiary lode in a cross-cut on the No. 17 level. Apparently the Santa Gertrudis may develop valuable resources by lateral exploration. This may go far to compensate the non-persistence of ore in depth.

RUSSIA.—The Lena Goldfields has closed another season, having won £1,251,564 in gold from 820,189 cubic yards of gravel. The yield is 34s. 8d., or 7'95 dwt. per yard, or 1'17 dwt. less per yard than last year. In addition to this output, the company purchased gold worth £82,879; on the one hand this sum does not represent the full value of the gold, on which, therefore, a profit is made; on the other hand, it is merely the ransom on metal stolen by the workmen. In effect, it is an addition to the wages.

Mr. R. Gilman Brown's estimate of ore assets in the Kyshtim mines shows no important change, the slight decrease of 'probable' tonnage being due to diversion of energy from the proving of orebodies already known to the search for new ones. A new bore-hole on the Koniukoff has proved the ore to 1000 ft., and another hole on the Amerikansky has proved that orebody to 740 ft. The completion of the new reverberatory furnace will increase next year's output of copper, provisionally estimated at 9000 to 10,000 tons.

The Sissert is undergoing satisfactory development, although most of the work is in low-grade ground. Assays range from 1'63 to 1'71% copper, except in the western lens of the Sysselsky mine, where a width of 45 ft. of 4% ore has been proved on the 210-ft. level. Drilling on the Gumeshevsky has disclosed 215 ft. of 1'61% ore at a depth of 568 ft. On



Map showing position of Kirkland Lake.

the Degtiarsky area the drillings indicate 11 ft. and 13 ft. of low-grade ore.

The Spassky is just being opened up at the 630-ft. level, a cross-cut having penetrated into the lode, exposing 19 ft. of ore averaging 12% copper, mainly in the form of bornite. This compares well with the corresponding point in the level above. The main orebody in this mine is 30 ft. wide and 250 ft. long, yielding an output of 20% copper, without the second class ore, averaging 8%, which is being accumulated pending the completion of a con-

centrating plant. The production is from 400 to 450 tons of metal per month. At the Atbasar, which now belongs to the Spassky company, the previous exploration by boring is being verified by systematic development. The ore is a sandstone impregnated with bornite, giving an average yield of 9% copper. The workings are shallow, only down to 250 feet, for the deposit has a flat dip conforming to the Permian strata. The erection of the smelting and concentrating plant was begun in August. Mr. H. C. Bayldon is manager.

INDIA.—In addition to the North Anantapur and Jibutil properties, in the Anantapur district, the Ramagiri block is being actively developed by the parent company, the Anantapur Gold Field, Limited. Development on the 200-ft. level has disclosed the lode to be a foot wide and to assay 1 oz. gold per ton. On the 300-ft. level, the small amount of work done so far has shown that the lode is from 1 to 3 feet wide, averaging 10 to 40 dwt. per ton. It is probable that additional capital will be subscribed shortly for continuing the work, and a subsidiary company formed. In the Kolar district, the discovery of profitable ore on the 3175-ft. level of the Balaghat has revived the hopes of shareholders. The Champion Reef pays 50% dividend for the year ended September 30, the same as for the previous twelve months. Developments in depth continue to be satisfactory, for at a number of points in Glen's and Carmichael's sections the lode averages nearly 2 feet wide and assays from 25 to 45 dwt. The slime-plant for the Mysore, having a capacity of 500 tons per day, has been shipped from England.

CORNWALL.—The report of Mr. W. H. Trewartha-James on the Carn Brea & Tincroft has not been officially published, but we understand that the Carn Brea section is to be closed and development concentrated on the North Tincroft. The Wheal Jane mine, near Truro, belonging to the Falmouth Consoli-

dated, has been closed, after the company had gone into the hands of a receiver three months ago. This is the mine that was alleged to have enough ore to supply a thousand stamps.

VARIOUS.—On November 19 it was announced officially that 4000 men had returned to work at Rio Tinto without further incident.

The Cape Copper company is issuing £200,000 new capital, for the purpose of equipping the Rakha Hills copper mine, in Chota Nagpur, India. The option on this mine was exercised a few months ago. The development work has been done by Mr. Charles Olden, who reports the reserve at 142,000 tons averaging just over 5% copper, and 97,000 tons averaging from $2\frac{1}{2}$ to 3% copper. The company has during the past two years spent large sums out of profits in remodelling the smelting works at Britonferry, South Wales.

The Andrada Mines Co., of Paris, operating on the Revue river, four miles from Macequece, in Portuguese East Africa, has completed its $7\frac{1}{2}$ cu. ft. dredge, built by the Bucyrus Company, and will start digging as soon as the 1000 h.p. power-plant is completed. We publish an article by the engineer in charge, Mr. C. T. Nicolson.

Another of the famous gold mines, the Redjong Lebong, in Sumatra, is nearing its end. Six years ago it yielded 22 dwt. per ton; during the last year the average was $11\frac{1}{2}$ dwt.; but now it is only 9 dwt., with ominous silence as regards the bottom, which is only 600 ft. deep. The only promising mines in Sumatra now are the Salida, close to Padang, and the Simau, in Benkoelen. The former is an ancient mine, and was worked by the Dutch East India Co. The Simau is crushing 7000 to 8000 tons of 12 dwt. gold ore monthly.

Heavy rains and landslips have hampered the Tronoh, so that the November output shows a decrease. The cost of operations has increased continuously since March, so that the margin of profit is dwindling.

EDITORIAL

WE publish another letter on Rio Tinto affairs from our correspondent at Huelva. Evidently he is well-informed. However, we are inclined to differ from him on one point: he does not distinguish between the administration and the staff.

NON-TECHNICAL papers easily fall into errors when reporting mining affairs. Thus Mr. F. F. Fuller, the secretary of the Avino Mines, had to correct the *Pall Mall Gazette*, which gave the Avino's liquid assets as £113,190, when they were only £13,190, and credited the mine with the extraction of a large quantity of tin ore, when the product from the property is copper.

A NEWSPAPER in New York has been quoting sundry sentences out of our Toronto correspondent's letter in October as if they came from a report made by the present writer on a specific mine at Cobalt. Of course, the editor of this Magazine neither inspects nor reports on mines, nor takes any part whatever in the business of mining. The use of his name is evidently made with fraudulent intent.

IN *The Times* it was stated recently that "the Stock Exchange affords facilities for gambling." Whereupon 'Alpha' writes to take exception, submitting his opinion that "you cannot gamble on the Stock Exchange" because the speculator must pay on the settling day for every share he buys, or get someone to pay for him, and must deliver on the settling day every share he sells, or get someone to deliver for him. To this 'Omega,' replies that apart from the "little flutter" possible between the settling days, in which case the speculator need neither pay nor de-

liver, it is a fact that the Stock Exchange does afford facilities for gambling "by providing a well-organized system by which the speculator knows he will get one of its members to pay or deliver for him when the settling days come." This is what 'continuation' day means. Thus the last word is evidently best; 'Omega' concedes to 'Alpha.'

SEARCH for oil has become an industry involving the application of geology and engineering to such an extent as fully to warrant the formation of an Institution of Petroleum Technologists. This has been done by Sir Boverton Redwood and others conspicuous in the oil industry. But we cannot congratulate the sponsors of the movement on the manner of their start. Lord Cowdray was urged to be the first president, but he, most sensibly, demurred to the honour as he is not a technologist. Whereupon, with curious lack of logic, he becomes Vice-President. Among the founders are many similarly unqualified on the technological side, so that we may presume that the new organization is to represent those generally who are interested in oil exploitation. Such an institution may become influential in business, but it will have no recognition in technology.

IN A PAPER on electric blasting by Mr. William Cullen, read before the Chemical, Metallurgical, and Mining Society of South Africa, at Johannesburg, it was stated: "In view of the fact that in practically all of its branches Rand mining is probably the most up-to-date in the world, it appears somewhat extraordinary that until quite recently no organized attempt has been made to test the possibilities of electric blasting." This is not said with undue arrogance, but it expresses a

fallacy that has been a constant check to technical progress on the Rand. The idea that the mining and metallurgical practice of the Witwatersrand was ahead of that of the rest of creation, and the calm assumption that everything worth while had been tried locally, accounts for many egregious blunders and belated applications. Whenever a man or a community is too smart to learn, he or it is in a bad way. Blasting by electricity is old in any but a geologic sense.

READING a report from Berrida, in Nigeria, we found an unexpected reference to technical writing. The humour of it was appreciated by the reformer mentioned. In that report Mr. J. J. Hunter makes a playful apology for the use of untechnical language in referring to "some rich patches" of tin gravel that "will *sweeten up* the yield." This is expressive and in no way objectionable, if only the *up* is deleted. A thing is not sweetened either *up* or *down*, except as any intensifying of a quality is viewed *crescendo*. Homely, but expressive, phrases are not out of place in a mining report; indeed, the use of more of them, correctly, would undoubtedly facilitate the transfer of ideas from a manager to his directors or shareholders. It is to technical terms employed with bucolic carelessness or to the pretentious phraseology of a half-baked technologist that we object. If Mr. Hunter is still in a receptive mood we shall make a plea for the abolition of the unnecessary plural, as in abbreviations (like 'lbs.' and 'ins.'; why not 'fts.?') and in such words as 'tailings' and 'concentrates.' The product from his mine may be a concentrate containing 70% tin, and the various mines may produce concentrates of varying composition and richness. It is not the individual particle but the aggregate of heavy particles that constitutes a 'concentrate.' Similarly a mine may yield one 'ore' or several 'ores,' but it is inadvisable to speak of 'ores' if only one kind

of ore is produced. A 'sampling-book' should not be written either a "sampling book" or a "samplingbook"; nor should it "overestimate the values." It might over-estimate the tin contents of the gravel. The 'value' of an ore is its worth in money. When figures are "accurate," that suffices; when they are described as "very accurate," they are either unusually accurate or almost accurate. 'Reefs' is an Australian vulgarism, adopted in South Africa. In Nigeria it will be well to discard such bastard products, and utilize the legitimate terms that are legal tender wherever English is spoken: 'Veins' or 'lodes' are verbal coins of irreproachable mintage. Such details are worthy of note even in the West African jungle. It only remains for us to express the hope that Mr. Hunter will be able to report delightful results in unimpeachable language; in any case, we wish him the success that is more eloquent than words.

AT THE MEETING of the Amalgamated Properties of Rhodesia, an appeal was made by the chairman, Mr. G. R. Bonnard, for fair criticism in the press. He attacked the practice of printing anonymous letters, and asked the editors of the financial columns to insist upon the publication of any correspondent's name and address, so that the claim to speak as a shareholder or as a reputable critic may be substantiated. Mr. Bonnard also asked editors to require proof that the complainant had appealed vainly to the officials of the company for the information desired. All of which is quite reasonable. We dislike any sort of anonymous criticism, not only because of the obvious opportunity for malicious attack, but because most criticism in business matters depends upon the man behind the gun. For example, we did not care for Mr. J. D. Helm's criticism of the Esperanza management until he forwarded a signed letter for publication. Then we gave the company's consulting engineer an

opportunity to reply. Such controversy clears the air. We object unreservedly to unsigned letters reflecting upon the honour of individuals, and we have no sympathy whatever with editorial criticism that attacks by innuendo. It is good journalism to give names, because names are interesting and because it gives the persons so designated a chance to reply, which is also interesting and useful. Of course, occasions do arise when a correspondent, known to the editor as trustworthy and well informed, makes a criticism that he must leave unsigned, for fear of unfair reprisals. But if his name is withheld, the responsibility shifts to the editor himself, who then stands behind his informant and becomes sponsor for his correspondent's statement. The atmosphere surrounding press criticism would be further sweetened by the recognition of a fundamental fact, namely, that editors should be detached onlookers, neither participating in share speculation nor casting a jealous eye on the advertising pages. When that is recognized, it will remain to taboo the holding of shares by nominees, so that improper transactions may not be made in the dark.

TIN-DRESSING in Cornwall was again before the Institution at the November meeting. Clearly the foreign devils have broken into the Forbidden City, and caused a commotion. Cross-currents of prejudice were plainly apparent in the discussion of the paper which was one prepared by Mr. Horace G. Nichols on the experimental work accomplished in the Geevor mill. Leaving the discussion for a moment, we turn to the final episode, when Mr. Oliver Wethered made a speech attacking Mr. Nichols for submitting the paper to the Institution without his permission as the chairman of the company in whose interest the metallurgical test was made. Apart from the merits or demerits of the case, we venture to express our astonishment that an accomplished man of the world should have

permitted himself to be guilty of such a solecism as to impugn the professional conduct of a member of the Institution at a meeting to which he himself was admitted as a guest. Mr. Nichols is an Associate of the Royal School of Mines and an engineer without reproach. That should suffice. For the rest we have inquired into the causes leading to the unpleasant episode. The facts are these. The paper was written at the suggestion of Mr. R. Gilman Brown, who was then serving as consulting engineer and director to the Geevor Tin Mines, Ltd. The permission of this technical director was sufficient warrant for Mr. Nichols. A further reason for publication arises from the fact that after the mill had been remodelled, a number of changes were made without the consent of either Mr. Gilman Brown or Mr. Nichols, and the changes were such as both of them deemed hurtful to the efficiency of the plant. Mr. Gilman Brown resigned, and Mr. Nichols prepared a paper with a view to preserving the technical facts and justifying the technical procedure. This was the sort of thing that should be done to protect an engineer's reputation and to render the results available to others. If Mr. Wethered questions the effectiveness of the mill as described in Mr. Nichols' paper, let him give authority for the publication of a similar series of tests at the mill after it has been changed by his orders. His own statement on the subject is deserving of polite consideration, but it is without technological weight. In his speech he shadowed something of the kind. It remains for him to make good.

AS for the paper itself, it was an excellent technical description of a mill-trial illustrating careful grading, followed by the use of modern classifiers and pulp-thickeners, but it suffered from two omissions. Mr. Nichols made no reference to the fact that the design of the plant, for reasons good or bad, had been radically changed since the date of

the operations he recorded. Moreover, he brings the product to the stage of a 32% concentrate, and does not state what further loss may be involved in the final dressing before it is sold to the smelter. It was a great pity that this information was not given explicitly, when it became evident that the discussion was at sea for the want of it. We think that the chairman might have insisted on the point being cleared early in the proceedings. The ancient miner of the Cassiterides was defended against the attack of the 'uitlanders' by Messrs. J. H. Collins and W. H. Trewartha-James. Mr. O. J. Steinhart raised a laugh by insisting that the Cornishman does classify without intending to do so. There was some talk about 'crop' tin, meaning the coarse easily separable cassiterite, but it was unconvincing, in view of the fact that the Cornish treatment is essentially a reduction of the ore to slime, for the sufficient reason that the tin mineral is so fine that it cannot be concentrated otherwise. Mr. J. J. Beringer made more than one humorous observation, as when he referred to particles so minute that they went through a 200-mesh screen "three abreast," and when he ridiculed the meticulous precision of 66'66, which he presumed meant two-thirds. "If there were a few more sixes, I would be sure of it." We expect to hear and say more on the subject in our next issue, when the discussion will have been concluded. In the meantime we refer our readers to an abstract of Mr. Nichols' paper in our *Précis of Technology*, which judiciously introduces useful explanations.

KIRKLAND LAKE is to the front owing to the circulation of a prospectus that, at first sight, looks like a financial gasconade. Three gentlemen offered 50,000 shares out of 200,000 in the Kirkland Lake Proprietary, on the strength of arrangements "now in course of negotiation" involving sundry unspecified business to be done in this

new district of Ontario. The three directors are Mr. H. G. Latilla, formerly a henchman of Sir Abe Bailey, Mr. C. A. Foster, a successful mine operator at Cobalt, and Major R. P. Cobbold, a big-game hunter and an explorer not unknown to fame. We understand that the issue was subscribed five times over before the prospectus went into print, and that the publication of the prospectus was mainly in deference to Stock Exchange requirements. Although no information is given, we understand that an option on the Tough Oakes mine is part of the business in hand. That mine has a rich vein that has yielded sundry carloads of ore running 20 to 25 ounces of gold per ton. Several other veins have been discovered. The most productive has been traced for 400 to 500 feet on the surface, and to a depth of over 200 feet in a shaft. On the first level the ore extends 100 feet on each side of the shaft, and at the second level it has been traced so far for 120 feet. The specimen ore is from 2 to 15 inches wide, and is flanked by 6 or 7 feet of low-grade stuff. Other prospects, less mature, are the Burnside, Wright Robbins, and Teck Hughes. We advise caution. The best ore is of a specimen character, such as is prone to intoxicate the imagination of those without experience.

AN unusual incident has occurred in connection with the appeal by the Elmores to the Judicial Committee of the Privy Council from the decision of the New South Wales court in their action against the Sulphide Corporation at Broken Hill for the alleged infringement of their flotation patents involved in the use of the Minerals Separation process. The appeal was heard before three judges seven weeks ago and judgment was reserved. After the lapse of a fortnight the litigants were informed that the Lord Chancellor had ordered a re-hearing of the case in January before a larger court. No reason was given for this

course being taken, and it would be idle on our part to indulge in speculation as to the motive that prompted the Lord Chancellor's action. We may, however, direct attention to the fact that of the three members constituting the court that heard the appeal, two had already given judgments in the English case, one on each side. An equally disconcerting event has occurred in connection with the action in the United States court by Minerals Separation against James M. Hyde based on the use of the process at the Butte & Superior mine in Montana. That action had resulted in favour of the plaintiffs, as recorded in our issue of September. It came as a surprise therefore to find that the victory was a barren one, and that Minerals Separation had to commence an action against the Butte & Superior company. Moreover, the defence was a variation, and consisted in the claim that the company is using more than 1% of oil, thus differentiating from the Sulman-Picard-Ballot patents, which expressly mention minute quantities. The judge after a patient hearing confirmed his previous decision, but admitted that the arguments should be put before the court of appeal at San Francisco. He ordered the Butte & Superior company to enter into a bond to provide a complete record of the work done at their plant in the meantime.

M.I.M.E. and M.I.A.M.E.

We note that an excerpt from a report on a Californian oil property appears in a recent prospectus, and the credentials of the engineer making that report are expressed by the letters M.I.M.E., M.I.A.M.E. This luminous tail looks large, but it conveys little. It is fair to say that for the purpose of protecting the British public and instructing speculators in London, it is highly desirable that reports should be furnished by engineers of good standing in this community, that is to say, by members of the Institution of Mining and Metal-

lurgy, which is the recognized organization of metal-mining engineers in Great Britain. At the same time, we suggest that quotations from bulletins of the United States Geological Survey or from reports by the State Mineralogist of California, while not lacking in academic interest, cannot be regarded as valuable testimony concerning the commercial merits of a mining enterprise. They are not written with reference to a particular undertaking, and they are not linked to the financial conditions modifying the success of that undertaking. English investors are entitled to expect promoters to furnish confirmatory reports by engineers of repute in London.

Even Methuselah Died.

Remarkably little has been said in the financial press concerning the statement by Mr. H. H. Webb, in the Gold Fields report, concerning the impoverishment in depth of the banket deposits exploited by his company. He says: "There can be no doubt that from our experience and in our mines the average value of the ore developed over large areas has been getting lower as great depth is attained." The properties of the Consolidated Gold Fields of South Africa are not unique in this regard. We note that operations have ceased in the Cinderella and Jupiter mines, two of the deepest on the Rand, the depth attained being 4627 and 5040 feet, respectively, according to the Government Mining Engineer's report. The Simmer East, which is 3550 feet deep, is also defunct. The statement by Mr. Webb is the first official acknowledgment of a brutal fact, although Mr. Frederick Hellmann, in 1907, before the Mining Industry Commission, at Johannesburg, testified to the same effect concerning the East Rand Proprietary mines and concerning the Rand generally. That opinion was kept from the public. Even earlier, namely, more than 10 years ago, on May 2, 1903, the present writer wrote an editorial in

the *Engineering and Mining Journal*, New York, on this subject. In that article, entitled 'Even Methuselah Died,' he protested against the glib talk then prevalent in London and Johannesburg, wherein the Main Reef series of conglomerate lodes was assumed to have the uniformity and persistence of a coal seam. He insisted then that gold-bearing lodes are not indefinitely persistent, although in various localities, for geological reasons, they differed as to their continuity. He deprecated the flamboyant assertions then rampant concerning the Rand, insisting that, while exceptional in extent, the ore deposits there, as elsewhere, must come to an end, from an economic point of view. It has taken ten years for this fact to be recognized officially.

Copper Practice in Gold Mining.

A remarkable phase of gold mining, hitherto more widely discussed from the financial than the technical standpoint, is being rapidly developed on the Alaskan coast. Conditions may have found some parallel in the growth of the 'porphyry' or disseminated copper mines, but they are without precedent in precious-metal mining. For many years the great low-grade gold deposits near Juneau on the mainland, across the Gastineau Channel from the Treadwell group, have been worked on a comparatively small scale. From the three main points of attack, the Perseverance, Juneau, and Ebner mines, which cover the three-mile ore-zone, over a million tons has been mined. The results attracted little attention, for their significance was reflected neither in dividends nor liquidations. The import of the returns lay simply in the basis provided for engineering estimates as to the latent possibilities of wholesale mining. It is on the strength of these estimates rather than the records of production that the locality now stands so boldly in the limelight.

Three strong firms are independently involved. At the Perseverance, now owned by

the Alaska Gold Mines, the Boston interests that are guided technically by Mr. D. C. Jackling and which control the Utah Copper, Chino, and Ray, are introducing the principles followed in the exploitation of the porphyry copper deposits. From the engineering viewpoint, there appears no phase of greater interest than this invasion of the gold miner's realm by leaders of the copper industry. The underground development and stoping of the wide deposits of Juneau must follow—with minor modifications—established mining practice, but the metallurgical treatment of the ore, in great quantities at minimum cost, presents problems that may be approached, and perhaps equally well solved, along radically different lines. The Jackling mill of 6000-ton capacity is being designed to employ the broad principles of copper practice. Breakers will be followed by rolls, roughing tables, classifiers, re-grinding plant, and concentrators. The aim will be concentrating efficiency rather than high recovery by amalgamation.

On the adjoining Juneau mine, where Mr. F. W. Bradley has quietly been conducting practical investigations and tests for several years and where natural conditions are broadly identical with those at the Perseverance, the conservative methods of the Treadwell are likely to be more closely followed. The stage to which Mr. Bradley's results have carried him is indicated, after a long and wisely non-committal silence, by a recent declaration of resolved initial equipment of 1,000,000 tons annual capacity, with a prospective increase of plant to 4,000,000 tons. At one time Werhner, Beit & Co. were largely interested in the Alaska-Juneau, which was purchased by Capt. Thomas Mein in 1896, but the firm withdrew without taking any active part in its development. The necessity of economical management, low working cost, and wholesale mining possibly deterred the Rand's exponents of selective mining from participating

in a venture of such gross and vulgar requirements. Northwest of the Juneau lies the Ebner, where the United States Mining, Smelting & Refining Co. is driving a deep-level adit. Mr. Sidney Jennings has endorsed the estimate of low working cost made by the Alaska Gold Mines.

Estimates of production and cost for this low-grade belt must necessarily be so fine that the difference between 'grade' and 'yield' becomes of critical importance, and the allowance to be made for depreciation and contingencies may be keenly debated. For the Perseverance, the yield is roundly placed at 6s. per ton and the cost at 3s. With a complete equipment, the difference of 3s. should be distributable profit; on the basis of which simple deduction the mine is now valued in the market at £4,000,000. Capital expenditure to place the property on a productive basis will exceed £1,000,000. A difference of 6d. per ton in yield or cost would affect the valuation by over 15%. The cost of underground stoping will be the factor of chief concern. But the success of these mines for 5 years should mean their success for 50, and herein lies the speculative prospect of expansion to standards of capacity beyond present assumptions. It is at least assured that the Juneau lodes will now be exploited to success or failure without a check. Being in the hands of men who—of different schools of thought and practice—have achieved some of the biggest work in American mining, there will be no question as to the finality of results obtained. Next year will continue to be one of preparation and the following year will only carry with it a partial settlement of technical problems. In 1916 the engineer's estimates of cost and yield should give place to the auditor's analysis and the destiny of the Juneau belt be definitely established. Mr. Bradley has been working from the neighbouring base-line of Treadwell efficiency, just as Mr. Jackling has triangulated himself north

from a porphyry copper orientation; and when they eventually arrive at the critical point of distributable profit, a close 'tie' may be expected in the co-ordinates of yield and cost.

Great Cobar.

On another page we comment upon the helplessness of shareholders as shown by the futility of their criticisms at annual meetings. A few days after those lines were written we attended the meeting of protest summoned by Messrs. F. Kimber Bull, and Rowland C. Feilding as shareholders in the Great Cobar company. This, it seemed to us, exemplified a much more effective method of redressing wrongs. In the first place, the atmosphere was in sympathy with the insurgents; instead of facing a grim array of gentlemen naturally inimical to the airing of grievances, the long-suffering shareholder could address his remarks to a friendly meeting, under the control of a friendly chairman. In other words, the tables were turned. And on this occasion, the organizers showed restraint. No personal attacks and no unfair imputations were made. The chairman, Mr. Bull, opened the proceedings with a clear indictment of the management, and by reference to known facts was able to prove his case, which was the necessity for a change in the directorate. He was followed by Mr. Feilding, who, as a mining engineer, dwelt more on technical matters, in order to prove as great an incapacity in the technical as in the business management of the Great Cobar group of mines. He proposed a resolution calling for a complete change in the board. While both he and his associate in the movement disowned any eagerness to become directors, it was obvious that both were willing to serve. We think that the agitation, while it was in no wise invalidated, was certainly weakened by the desire of its promoters to succeed the gentlemen under attack. The proposal that the number

of directors should be reduced from 8 to 5 found an ominous echo in the proposal to elect a committee of inquiry also 5 in number. There was one other blemish in the arraignment of the board and the management: no reference was made to the labour troubles that have been so important a factor in hindering efficient work at Great Cobar. We hold no brief for anybody, and therefore we say frankly that the omission to make allowance for this great handicap was unjust to Mr. H. C. Bellinger and also to the board. On the other hand, the recommendation of the firm of John Taylor & Sons as managers in Australia was entirely too premature, for we have reason to know that the mention of their name in this way was made without their consent. We are among those who consider that the appointment of this firm would be a factor of safety to the proprietary and would put an end to the share-market vagaries that have been so glaring a feature of the Great Cobar fiasco. We commend the suggestion made by Mr. Feilding, but not the time chosen to make it. After Mr. Feilding's resolution had been placed before the meeting, sundry gentlemen arose to support it, but they joined in objecting to a rejection of the entire personnel of the existing board, suggesting that it would be a mistake to re-organize affairs without the aid of some of those already familiar with the company's affairs. This gave an opportunity for others present to rise in defence of individual directors representing specific financial groups. At this stage we began to lose sympathy with the proceedings. To fulminate against the vagaries of the share-market and the lack of information given to shareholders, as if the two were connected phenomena, and then to propose this or that representative of a share-dealing corporation as fitted for directorship because of his connection with a financial group is illogical, to put it mildly.

It was stated by Mr. Feilding, speaking as a mining engineer, that the Great Cobar was

a property of "vast potentialities," and that "the present state of affairs is due to mismanagement rather than to any inherent defect in the mines themselves." In the last report, that of Mr. C. S. Herzig, the capabilities of the management were over-estimated, so said Mr. Feilding, but not the capabilities of the mines. If these statements are taken at their face value, the shareholders can prepare for further disillusionment. The Great Cobar fiasco is due to an over-estimation of the mine from the very first. Too much was paid for it; it was over-capitalized; it was burdened with excessive promotion profits; and it was started with an entirely insufficient working capital. More money can be lost by over-estimating rich mines than by endorsing poor ones. The original estimate of a production of 12,000 to 14,000 tons of copper per annum was never fulfilled, and never will be fulfilled. The mine can produce 7000 tons, or about one half the earlier estimates, and no more. It is foolish now to repeat the old blunder of exaggerating the capabilities of the property. They are not "vast." The Great Cobar itself has about 1,250,000 tons of 2'25% copper ore; the Chesney has 650,000 tons of 2'5% ore, and the Cobar Gold has 340,000 tons of 1'7% ore. In each case a little gold and silver sweetens the copper, and in the case of the Cobar Gold an average of 6'8 dwt. gold per ton justifies the name. In the Great Cobar, two out of the three main orebodies do not persist below the 11th level, for neither has been found on the 12th or 13th levels, while at the same time the central orebody has contracted in extent. The 350,000 tons of 4% ore enclosing the shaft cannot be extracted without gutting the mine; in other words this 350,000 tons is not a liquid asset, and it is not included in the figures given above. In the Chesney the main orebody shows shrinkage on the 8th level. In the Cobar Gold the ore on the 5th level shows improvement of grade, but contraction of size.

On the other hand, the eastern orebody in the Chesney looks well, and in the Cobar Gold another lode (the Jubilee) is decidedly promising. Other prospects exist on undeveloped claims. But the main orebody of the group shows signs of 'petering out' in depth. That is a fact that dominates the position after seven years of mismanagement, technical and financial. The company has paid one dividend only, and that was not warranted. Seven years is a long time in the life of a mine. The Great Cobar is no longer young; it is like a broken-down old man with misspent youth and a shattered constitution. The probabilities and possibilities might be attractive on a capitalization of £500,000, but when burdened with £932,710 in shares and £724,800 in debentures, they are small indeed. A profit of £140,000 may be earned for several years, but that is only enough to pay the interest on the debentures and provide for the redemption of them. The shares are left in the cold. The obvious thing is for the shareholders who control the mine to make terms with the debenture-holders who have a mortgage on it, so that both may obtain something out of the wreck. This is no time for rodomontade.

Directors and their Fees.

This question has arisen again, a complaint being made that the Santa Gertrudis directors drew double fees. It was also a topic at the Great Cobar meeting. In regard to the identity of the Camp Bird and Santa Gertrudis directorates, it would seem to us that the participation of the Camp Bird company in other businesses—such as the Messina and Bonanza—is a point not to be overlooked. The complaint might have been made when the Santa Gertrudis was only a holding company for the Camp Bird, but not now that the other has assumed new obligations. If the directors attend to their duties, we see no objection to their serving on two boards, whether allied or not. There is, of course, a limit to the capa-

bility of any person serving as a financial advisor or trustee; we have protested often against any individual undertaking to act as an administrator for twenty or more companies, as some South African directors have done; but the gentlemen under criticism in this case are moderately multifarious, so that, on the face of it, we see no particular point to the complaint. Nor do we sympathize with the objection to the fees, as regards the amount of them. This was a part of the indictment at the Great Cobar meeting, it being stated that eight directors drew £5000 per annum. This was paid to the board of a company capitalized at £1,650,000 in shares and debentures, and one controlling a gross output worth £750,000 per annum. For the administration of such an enterprise £5000 is little enough. What is required is not to pay less money, but to divide it among fewer persons, by eliminating the incompetents, dummies, and mere passengers. If the board consisted of one managing director or chairman, and two others, making 3 instead of 8, and if the £5000 were paid to these 3 instead of the 8, then the Great Cobar would be enabled to obtain the services of better men and the shareholders would also be in a position to concentrate the conduct of their affairs on three men sufficiently well paid to apply themselves to the business, and sufficiently few not to escape direct responsibility. If directors play their own game instead of acting as trustees for the shareholders, they are dear at any price. The idea of cost should be secondary to that of efficiency. But, on the other hand, we do not agree in the least with the argument used by Mr. Grenfell at the Camp Bird meeting. The directors, he said, were willing to forego their fees if they were given the profitable options secured by them for the company. He specified the various deals and participations, and concluded by saying: "You have only to agree to these proposals, and you will have had your affairs administered for

three years for nothing." This is idle spoof. If a trustee having obtained commissions or bonuses for himself or his partners were to answer criticism by offering to assume the successful deals concluded during his term of office in return for a surrender of his salary, he would be credited with a queer notion of humour. Mr. Grenfell said that "we all welcome honest criticism." Yes, and we also value sincerity in the replies to such criticism.

Such episodes as this again emphasize the need for regularizing the position of directors. They should be regarded as professional men, equipped by specific training and special aptitude for the work of company administration. They should be neither privileged speculators nor glorified jobbers, but trustees acting for the shareholders, who are the owners of the mine.

Engineer's Equipment.

Anything that Mr. James Douglas writes is sure to be helpful, for, like Mr. James Bryce, he has the quiet wisdom that comes from wide observation of men and things, conjoined to a philosophy that is the fine flower of common sense. We have just been reading a bit of advice that he gave to his fellow students—as he called them—in the School of Mining at Kingston, Canada. After advocating breadth of view and width of culture, he proceeded to make his chief point in urging the students to acquire the faculty of expressing their thoughts clearly in speech and writing. That is a faculty that most of all divides man from the lower creation, and most of all separates the effective man from the mob. To write clearly is a discipline for thinking clearly. To give information lucidly is the direct way to getting a firm hold upon it oneself. Mr. Douglas told the students that their acquisition of knowledge could be of no use to a neighbour unless they learnt to express themselves, and that meant the ability to win the interest of their neighbour, who was their natural em-

ployer. "To know how to express in clear language what you have to say is almost as necessary as having something really worth saying." Assuredly the fine idea or the good information that is smothered by inchoate expression will do no good to anybody. "You will have to write reports," said Mr. Douglas, "and you should write articles, and your reputation will depend not only on what you say but on the skill with which you marshal your facts and the clearness with which you describe them." We commend that to the younger men of the profession as the opinion of one of the most honoured and successful in their own calling. It is a curious fact that one of the accomplishments most useful to a young engineer, namely, to make a clear report, is not taught in schools of mines. Yet many is the man who is appraised by the directors, or by those who otherwise may employ him, according to the manner in which he writes a letter, compiles a report, or presents a statement. In many cases it affords the first mental contact with the man who wrote it, and, as such, it is an introduction that counts either for or against the person behind the writing. As for writing articles, and the reputation that comes of it, we can speak sympathetically, having taken cognizance of such work for many years. Undoubtedly a technical article by a young man, if based on information carefully digested and submitted in simple unpretentious English, will do more to take him from among the "and others" and the "also ran" than anything else that he can do. This is a highly competitive age. Every profession is crowded—that of mining and metallurgy not the least. To be capable is not enough; it is necessary to be known as a capable man. Some by social acquaintance can achieve the laudable purpose of becoming known as among the efficient, but the mental acquaintance that comes through the printed word is world-wide. Of course, there are those who appre-

ciate this, and appreciate little else. They have a facile pen, and they write the piffle that comes easily. But of these there are only a few, and they are soon eliminated by editors and other referees on whom devolves the task of selection. Apart, however, from the spur of distinction and wider acquaintance, the writing of technical articles is to a young man—and to the older ones also—a liberal education. It has been well said that the best way to learn something about anything is to start to write a book on it. The book need not be published. Anybody who begins to write on a given subject finds his information as full of holes as a sieve. These holes he proceeds to close by collecting data. Or, to use another simile, he carries in his head a lot of amorphous information, cumbersome and unready for instant use. In preparing to write, he re-arranges his information, he shapes it to useful purposes. The amorphous becomes crystalline. So we cordially endorse the advice of a wise and kindly man, repeating his suggestion to the students at Kingston: "Depend upon it that your success in life will turn to a very large extent upon your ability to express yourself in correct language."

Directors and the Press.

The controversy arising out of the criticisms of the Camp Bird and Santa Gertrudis directors serves to illustrate an interesting phase of joint-stock finance. Shareholders find it difficult to obtain information, not always or in all cases, but in respect of mines having an active share-market. To call on the secretary is generally futile. He is polite, but disarming. That is why he is there. If the news is good and has been 'released' by the board or the managing director, it is given to the visitor; if the information to hand is unfavourable, it is withheld or rendered innocuous. The shareholder does not go as a proprietor entitled to a frank statement, but as

a dependent trespassing on the good nature of the higher powers. If things go wrong at the mine, if he is kept in the dark until others appear to have obtained and used the latest information, he becomes angry and writes to the press. Sometimes he goes to the editor of a journal able to make a protest in his behalf. If he writes to the press, he does not sign his letter, and comes under the cloud of anonymity. This weakens his protest, for all sorts of people write letters to the financial press for sinister purposes. If he signs his name, he becomes anathema to the officials of the company. Should the editor take up the cudgels for him, the retort is made that this also is an anonymous attack, and the suggestion may be made that the editor is somebody's cat's paw. All of these aspects of the question have been illustrated lately. If the shareholder goes to the general meeting, he is handicapped by lack of experience in making speeches, he faces an array of officials inimical to his purpose, and he is at the mercy of a chairman who yawns fiercely, as Lord Harris did, or makes a sneering allusion, as Mr. Grenfell did. One other method remains, and that is, to call a meeting of fellow shareholders, as was done in the Great Cobar case, but this costs money, and involves a systematic campaign consuming lots of time and trouble. In the end he may become disgusted, and decide to buy bonds or debentures. Before he withdraws from participation in mining affairs, we desire to educate public opinion so that directors and secretaries will deem it politic to recognize the rights of the shareholder. And if the press is to perform this public service, it is necessary to cease the publication of anonymous attacks. They are futile. They are unfair. But, on the other hand, it will not do for Mr. Grenfell to call an editorial article 'anonymous.' The leaders in *The Times* are equally anonymous with those in the financial press. What are anonymous are the share-dealings through nominees. By all means let

the editors put their names to the critical articles they write, and let the directors buy and sell shares in their own names. Thus we shall make one big step toward both fairness of criticism and the removal of cause for criticism.

Camp Bird—Santa Gertrudis.

The parent company and the subsidiary held their meetings during the same week. We were unable to attend the first, but were present at the second. The chief feature at both meetings was the reply to attacks on the directorate made in the *Financial Times* and in *Truth*, both editorially and by anonymous correspondents. At the Santa Gertrudis meeting a shareholder, Mr. W. F. White, editor of the *Mining News*, rose immediately the chairman, Mr. Arthur M. Grenfell, had finished his speech, and made a bitter attack on the management. As a genuine shareholder he had good reason to protest against the belated acknowledgment of the error made in estimating the ore between the 18th and 19th levels, and as a journalist he was justified in resenting the attitude assumed by Mr. Grenfell toward criticism in the press. Mr. Grenfell explained the miscalculation of the reserve; it was due to the drift on the 19th level having followed the best part of the ore, so that inferences as to the grade of the full stoping-width proved wrong. This technical error has been frankly acknowledged, and all that we care to say is that the estimates of probable ore in the Santa Gertrudis have always been optimistic, from the time when the mine was appraised for purchase by the Camp Bird company. Such optimism is only too likely when the company's technical advisors are holders of large blocks of shares. It is only human to take a roseate view of your own belongings. The miscalculation was serious, and the effect of it on the shareholders was undoubtedly aggravated by the manner in which the unpleasant facts were disclosed to

them. The estimate assuming the uniform persistence of the orebody between the 18th and 19th levels was dated June 30, 1912, yet the first intimation of the blunder was received by the directors twelve months later, and the first information was given to the shareholders in August. We are compelled to insist that, whether intentional or not, the delay in disclosing so important a change in the fortunes of the mine is a reflection upon the management. As to the sale of shares in the interval, we know nothing more than has been stated in the press and at the meeting. Mr. White showed strong animus in his attack on Mr. Grenfell, and to that extent weakened the presentation of his case. Mr. Grenfell replied to some of the allegations, and disproved most of them, but not all. So long as shares can be transferred to nominees and deals can be effected without record, it will be impossible to obtain evidence on such matters, without a sordid detective campaign. We dislike anonymity in share dealings as much as anonymity in press criticisms. Mr. Grenfell saw fit to ignore Mr. White's attack, save by interrupting his speech and, when taking the vote on the accounts, by making a sneering allusion to the one dissident. In doing so he was a poor chairman. We went away with the impression that many of Mr. White's charges were unwarranted, but we concluded that some of them were warranted, and that it was difficult for Mr. Grenfell to reply without embarrassment. For instance, the statement made by Mr. White that he and three members of the Institution had bought shares on account of their confidence in Mr. R. J. Frecheville, was one that cannot be ignored. It is true, we believe, that Mr. Frecheville sold only a part of his holding during the current year. This illustrates again how difficult it is for an honourable engineer to traffic in shares without exposing himself to aspersion. If he buys shares it must be to sell them when it becomes profitable to do so. No

man buys shares in a mine to hold them until that day of liquidation which eventually comes to all companies. If he sells them when the mine is improving, he is plainly foolish. If he sells them when he obtains an intimation that the mine is sick, he subjects himself to attack for abusing a fiduciary position. Whenever he does sell, he is liable to criticism. We go farther and say that the directors of the Camp Bird must not be surprised if they are criticized and even attacked unfairly. The entanglements of their inter-company dealings and their own personal participations in such dealings expose them to reproach. At the time of the Santa Gertrudis flotation, we pointed to the unseemliness of their consulting engineer, Mr. J. Hays Hammond, participating in an enormous promoter's profit; we referred later to the premiums paid to the Canadian Agency, under which name the chairman and Mr. J. S. P. Samborne exercise their financial activities. Again, the Messina deal, which may have been excellent for the Camp Bird shareholders, was not checked by a disinterested engineer, for Mr. Frecheville, the consulting engineer to one company, is director of the other. Now comes the Bonanza affair in Nicaragua with Mr. Frecheville as an intermediate vendor, while also advisor for the purchaser. Of Mr. Orville Whitaker we know nothing. Why are the shareholders not protected by a report made, not for a vendor, but on *their* account? In other words, in such an important transaction, in which again some of the Camp Bird officials are obtaining a promoting profit, why are the shareholders and the public, which is a putative shareholder, not furnished with an independent opinion by an engineer known in London? Apart from the obvious value of such an endorsement to the promotion itself, it involves a procedure on which the public that deals in mines is entitled to insist. It serves to protect both directors and shareholders in the performance of legitimate business.

The Institution.

We are glad to believe that the criticisms appearing in these columns have been taken in a sportsmanlike manner by those in control of the premier mining engineering society, and we even venture to suppose that the usefulness of such criticism is now recognized. That is our warrant for further comment, intended, as heretofore, to be helpful. The time is opportune for suggestion. The officers of the Institution have accomplished an excellent stroke of business in the purchase of new quarters in Finsbury Circus, which is conveniently situated to that part of the City in which mining men most congregate. Having acquired convenient quarters, it remains, in a larger sense, for the Institution to put its house in order; in other words, to re-arrange its organization in conformity with requirements made obvious by the experience of the 21 years since it was founded. We refer particularly to the composition of the Council. This consists now of 1 president, 6 vice-presidents, 12 ex-presidents, 24 ordinary members, and 103 corresponding members, making in all not less than 146 members of the general committee having control of the affairs of the Institution. This is a large proportion out of a total of 1883 members and associates. As the corresponding members reside abroad, not many of them are able to attend the meetings of the Council, but they are entitled to do so and to vote, thereby introducing a disturbing factor of varying value, for on the rare occasions when they do attend they are usually unaware of what has transpired previously. Most of them it is true, have the good sense to act as spectators only, unless asked to express an opinion, but occasions have arisen when these casual councillors have exerted a marked influence on the decisions reached. Moreover, to speak frankly, it is known that many of the corresponding members would not be elected to the Council if resident at home, so that their right to at-

tend and to vote is one that they exercise on sufferance. On the other hand, several of the corresponding members are of presidential calibre, and their occasional appearance at the council-table is more than welcome; yet even in these exceptional cases, it is inadvisable that the vote should be exercised, since it may not be based upon adequate information concerning the agenda. The Council is so large—even the ordinary resident portion numbering 43—that exclusion reflects on a mining or metallurgical practitioner. It is true there are only half-a-dozen men whose names are missed from the list of representative engineers now constituting the resident portion of the Council, but we go so far as to say that it is undesirable that membership on the Council should be regarded as a professional asset, and that such membership should be used in business as evidence of special qualifications for professional work. The Council should be representative, and, in order that it may be representative, it is necessary to introduce the idea of rotation, that is, a large fraction should retire automatically each year and be ineligible for re-election in that year. But before this is done, the number should be decreased, so as to furnish sufficient suitable candidates and at the same time render the administration less unwieldy. The resident portion—as distinguished from the corresponding members—numbers 43. Of these 12, as ex-presidents, are perennial. Those who have passed the chair are, of course, an influential group, but it is a group that by yearly increment threatens to gain fixity of control over the affairs of the Institution. It has not done so yet, but if the ex-presidents live as long as we wish, and if their ranks are recruited annually, as is now the case, they will become an unalterable element, prejudicial to representative government. As to the vice-presidents, they also are too numerous. Two should suffice. Moreover, they also should be chosen from the elected members of Council. At present 20

members of council—1 president, 12 ex-presidents, and 7 vice-presidents—do not submit to annual election. Technically, and in spirit, although perhaps not in fact, they fail to be duly accredited representatives of the Institution at the present time. To remedy these anomalies and defects in the organization, it is necessary to make radical changes. The sooner the better, so that further development may not be hindered. We have no claim to speak save as an ordinary member detached by choice from participation in the official control of the Institution. We give our views frankly, with no idea that they will meet all the needs of the case, but as a friendly contribution to that end. First of all, the corresponding members of council should be dropped. If there is need for representatives abroad, that can be arranged easily otherwise. Members can be chosen for such a purpose, and without official designation in print. Such members or other members when in London can be invited by the President to attend a council meeting, either as a compliment or in order to obtain their advice on a special matter. The ordinary members of council should be cut down to 15, one-third to retire annually. This would leave about as many men eligible for membership off the council as would be on it. Election might then be based on attendance at meetings and other evidence of a vital interest in the affairs of the Institution. Several councillors are now conspicuous in their non-attendance at the monthly meetings. Next, only the ex-presidents for the three last terms should be ex-officio members of council, leaving the others—9 at present—to win election in the ordinary way. Then if the vice-presidents are cut down to two and are chosen from the Council, and if the President is also selected from that elective body, the number in the directorate of the Institution will become 18 only. This may seem a drastic reduction from 146, and it may involve a change too great to be acceptable, but we give it, without com-

promise, believing that it represents the ideal from which some divergence is practicable without destroying the essentials, namely, elimination of corresponding members and rotation among ordinary members of Council. We appeal to the present members of the Council to take the matter in hand, believing that it will conduce further to strengthen the growing influence of the Institution.

Consolidated Gold Fields.

A large attendance at the annual meeting indicated the important position occupied by this corporation. Lord Harris was in the chair and presided with admirable skill. He made the best of a bad case, and, therefore, won the sympathy of most of his hearers. Shareholders usually appreciate that they are in the same boat as their directors, and they hesitate to indulge in destructive criticism of the management lest the market in their shares should be affected adversely. On this occasion Lord Harris ran over the accounts as cheerfully as possible, and more cheerfully than the average shareholder would have found possible. Among the salient facts were a total depreciation of assets amounting to £1,402,201, a withdrawal of £1,000,000 from the reserve, and a net loss of £308,314 on the Simmer & Jack East. He spoke of the "frightful" and "undue" depreciation of the company's investments, and acknowledged that the year had been one of many disappointments. The Balkan war and the labour troubles on the Rand had depressed the share market, and a quite improper trade boom had diverted public interest from speculation. However, the properties in South Africa had good prospects yet, and meanwhile the American business of the company was coming to fruition. He gave an interesting technical account of the Searles Lake scheme, and of the Mexican oil venture, with briefer references to the Trinidad oil, the Colombian platinum, and the Mississippi power enter-

prises in which the Gold Fields American company is heavily interested. For the Gold Coast he had no good to say; as to Nigeria he was hopeful. For Rhodesia, he and his co-directors had a sentiment on account of the great founder of their company, Cecil Rhodes. He prophesied "a very considerable increase of interest" in Rhodesian mining during the next year, largely on account of the commencement of crushing at several new mines, meaning, of course, the Shamva, Antelope, Falcon, Cam & Motor. Whether that "increase of interest" will be altogether of a pleasurable character, remains to be seen. Of the total loss for the year, 95% was incurred in connection with South Africa, but the distribution as between Rhodesia and the Rand was not indicated. Later, in reply to a question, the chairman stated that the company's investments in Rhodesia represented £670,000, of which £120,000 was in the form of loans to sundry mining companies. The speech ended in a rising note, regretting the disappointments, but making no apology, protesting that he and his colleagues were "undismayed," claiming that their methods were accepted as "fair and honourable," and finally expressing "immense confidence that the revenue of the company must increase very considerably at no distant date." It was a good fighting speech. Mr. E. Birkenruth followed with an explanation of the Jupiter and Simmer East fiasco. This was necessarily depressing. Then came the turn of the shareholders. First a gentleman from Sheffield drew attention to the drop in the quotation, from £7 to £2, since he bought his holding, 15 years ago. He proceeded in the coolest manner to tell the gentlemen behind the head table that they had proved themselves incompetent and ought to resign; he added something about a committee of inquiry. While he was speaking the noble chairman was yawning fiercely, and casting sardonic glances at his colleagues. The attack was harmless.

Then another shareholder arose, and in feeling accents retailed the story of his loss, his holdings now at £2 having averaged £5 per share; he blamed the directors for their Rhodesian adventures, and for selling good holdings on the Rand, he talked about eminent Civil servants who accept positions for which they are not fitted, he referred to the tragedy of Lord Dufferin, and he wanted to know what profit had accrued from the American ventures. Beginning to ramble, he provoked interruptions and calls to "sit down." However, he had his say. That also furnished no effective criticism. Then Mr. Aubrey Hyman caught the chairman's eye, and proceeded to make a confident onslaught. He held that the statement of profits was misleading, he drew an unkind comparison between the Rand Mines and the Gold Fields, he sneered at the Rhodesian diversion, he predicted the near end of some of the subsidiary companies, he questioned the directors' ability to make money in America, and on the whole he gave the impression of one determined to depreciate Gold Fields shares. In short, he talked like a bear. Of course, Lord Harris scored his point by suggesting that Mr. Hyman's remarks were intended to depress the quotation, but to this Mr. Hyman retorted, not unfairly, that the remarks of the chairman were intended to lift them. The chairman replied by thanking the shareholders for their indulgence, he expressed his sympathy with the two gentlemen who complained of their losses, he insisted that the present board was not responsible for the original choice of the property owned by the company on the Rand, he defended the Simmer East finance, and asserted that, despite Mr. Hyman, Rhodesia was not quite despicable. The resolution approving of the accounts was passed with one dissentient, namely, the gentleman from Sheffield, and the meeting was over, save for some minor formalities.

We found it interesting, as illustrating some

of the weaknesses of joint-stock finance. The criticisms from the body of the hall were futile. One was too 'slim,' the others were too simple. Being there by courtesy, we could ask no questions. Otherwise we should have asked how Lord Harris reconciled his references to 'investments' with his statement that "mining is a gambling business to a large extent." 'Investments' is the term appearing in the accounts. Of course, it is humorous to use such a term to denote the shareholdings of a speculative concern like the Gold Fields, which plays the market just like Mr. Hyman, if he will forgive the comparison. Lord Harris took the unction to his soul that he and his colleagues were acknowledged as fair and honourable in their corporate dealings in mines. We happen to know that the general opinion of the mining profession, particularly those acquainted with the performances of the Gold Fields in Rhodesia and Nigeria, is nothing like so kindly. The Anglo-Continental affair reeks of jobbery, the Giant episode is malodorous, and the Shamva is nothing to provoke respect. We hold it radically improper for a company that administers mines to be engaged concurrently in playing the market. We regard it as subversive of business morality for the same group of persons to act as promoters, engineers, directors, jobbers, and share speculators. The public is learning to think so. As yet it is impotent to express itself at shareholders' meetings, save on rare occasions when an extraordinary scandal provokes a capable speaker and a man of some authority to arise in the body of the hall. Meanwhile, it is our self-imposed duty to educate public opinion in these matters, until directors, who in their personal affairs are scrupulous, and engineers, who in their ordinary relations are honourable, are shamed into bringing into the business of mining some of the niceties of that code of conduct to which they subscribe in their private dealings.

ROYAL SCHOOL OF MINES

University Annexation.—The report of the Commission on University Education has a bearing upon the future of the Royal School of Mines, as was indicated in our last issue. The Governing Body of the Imperial College is not unsympathetic to the fears of the friends of the School. The R.S.M. Association, of course, is keenly interested, and has taken such action as seemed politic. All R.S.M. men are a unit in striving for the preservation of the identity of the old School and of the A.R.S.M. degree. If the new development did not involve a loss of either, then they might view the impending change with resignation although without pleasure. The School has been blown about by conflicting interests until all that is asked now is the chance of a final anchorage where it can do good work comfortably. Being a school of applied science it has found a most satisfactory mooring with the Imperial College, and was willing to continue a connection that gave promise of being more pleasant year by year. The absorption by a mushroom university presents no attractions. Even the obtaining of a university degree is no catch, for the A.R.S.M. is worth more than anything London University can give those about to start a career in mining or metallurgy. Moreover, while the School is now comfortable as an integral part of the Imperial College, it will lose its vitality as soon as it is smothered by absorption in a local university. If the old students had been organized long ago, as they should have been, it is likely that they could have protected their Alma Mater more effectually.

Post Graduates.—Appointments to post-graduate courses have been awarded to Messrs. J. W. Lake, H. R. Ruggles-Brise, B. T. Altson, and C. M. Wilkinson. One goes to the Cordoba Copper Co., in Spain;

two others to the Rand; and the fourth to the Great Boulder Perseverance, at Kalgoorlie. Incidentally, we are glad to record that all four are members of the R.S.M. Association.

Conversazione.—The R.S.M. and R.C.S. conversazione will take place on December 18. A special display is to be made of the machinery and plant in the Bessemer laboratory. The mining and smelting of copper is to be illustrated, first by imitation underground workings, then the ore will be wound aloft to pass through breakers previous to concentration, after which the roasting and blast-furnaces will be seen in operation. A hand rock-drilling competition should contribute to the amusement. In short, it is to be a unique technical entertainment. A concert and a dance are also promised, not to mention refreshments and supper. Tickets are obtainable from Mr. E. A. Wraight, Royal School of Mines, South Kensington; the price being 2s. 6d. (supper extra).

The Union.—The annual dinner on the 11th inst. will take place after this goes to press, but we may venture to predict that Mr. William Frecheville, A.R.S.M., Professor of Mining, will take the chair. The toast of the R.S.M. Association, proposed in felicitous phrase by Dr. Frederick H. Hatch, will be acknowledged by the Hon. Secretary of the Association, who will take the opportunity of announcing that the Executive Committee has decided to ask all the fourth year R.S.M. students to come as guests to the first annual dinner of the Association on March 17, so that they may make the personal acquaintance of the graduates of an earlier period and obtain, possibly, some useful suggestions on the threshold of their career, while imparting some of the insouciance and joyousness of youth to their venerable seniors.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Nov. 1913	Oct. 1913	Nov. 1912.
£68. 8s. 9d.	£73. 9s. 5d.	£77. 0s. 0d.

The decline that began at the end of October continued throughout November and prices have lost over £10 in the month. Such a rapid fall anticipated the deterioration in the statistical position that has developed, and the alarm signal was given in the heavy production and increased stocks in America for October. Since then the European stocks have also registered an increase, and it becomes a question as to how much the fall in price is due to increased stock or the increase in stock is consequent on buyers' determination to hold off the market while the fall is in progress. Buyers are certainly ill provided, but it is also certain that trade, at least on the continent, is falling, while new orders are not coming freely.

The American producers have followed the fall in standard copper to a limited extent, the Amalgamated Company reducing their price after other producers had met the market. It is felt that they have sold sparingly, and that they must hold considerable unsold stocks. The amount of these stocks no doubt keeps prices down. European consumers are only waiting for some sign of a turn upward in the course of prices to buy freely for December and January shipment. Such a sign would be given if these producers would likewise meet the market, and get rid of some of their accumulations. Further shipments of English standard copper were made to America, but they have had no effect on prices.

TIN.

Average prices of cash standard tin :

Nov. 1913	Oct. 1913	Nov. 1912.
£181. 0s. 0d.	£185. 0s. 3d.	£227. 16s. 10d.

The market for tin has been extremely depressed, and the statistical position has emboldened bears to sell freely. A syndicate formed to operate on the bull side is meeting with little success, in face of so much discouragement, both from trade decline and increased supplies. The fall of about £60 from the highest certainly lends hope that the end may be in sight, but indications do not yet point in that direction. China is again in the market with stocks long held back in expectation of enhanced prices, and Bolivian ore is being shipped in increasing quantities. American demand has long been slow, and

Welsh tinplate makers show distrust of the future. The Banka sale went at £182. 15s.

LEAD.

Average prices of soft foreign lead :

Nov. 1913	Oct. 1913	Nov. 1912.
£18. 13s. 9d.	£19. 9s. 5d.	£18. 4s. 7d.

Here again markets have been depressed. The closing of the Russian navigation has freed supplies for other buyers. The fall for the month is over £2 per ton, and it is safe to say that the decline has been much overdone. Supplies are no more abundant than they have been in the past months, and a growing demand is certain after the turn of the year. Purchases for December are much below normal, and as stocks in consumers' hands are negligible a good many orders have to be placed. Forward purchases are as usual ignored, and it is astonishing how reluctant consumers show themselves to take advantage of the heavy backwardation ruling for so long. At the present level, buyers would be well advised to cover all sales made. Prices are bound to recover on the first sign of a revived demand.

SPELTER.

Average prices of good ordinary brands :

Nov. 1913	Oct. 1913	Nov. 1912.
£20. 14s. 4d.	£20. 13s. 9d.	£26. 14s. 3d.

Spelter has been quietly firm, with a better demand from consumers. The prices show an improvement of about 10s. since the liquidation of a London bull account. Galvanized sheets have again been active after a long period of dulness. The spelter syndicate at their last meeting made no change in prices, which stimulated demand. A good deal of business has been done for spring delivery at good prices.

OTHER METALS AND MINERALS.

Prices quoted on December 10 :

SILVER.—27d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£81 to £83 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£29 to £30 per ton.

QUICKSILVER.—£7. 10s. per flask.

MANGANESE ORE.—9d. to 10½d. per unit.

IRON ORE. — Cumberland hematite 23s. per ton at mine. Spanish 19s. delivered.

PIG IRON.—Cleveland 49s. 6d. per ton. Hematite 61s. 3d. per ton.

WOLFRAM ORE.—33s. per unit (1%).

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

HUELVA.

Rio Tinto.—The great general strike of October-November 1913 is over. So far, however, from the result being to improve the relations between the Spanish workmen and the English administration, these relations are if anything worse than before. The men's leaders hail the result as a victory for their cause and for the Union, accept the Company's concessions as an instalment, and will commence forthwith preparations for another general strike so soon as the Union shall be financially strong enough. The political object of the strike has been fully attained, a homogeneous band of Socialist councillors having been returned to the municipalities of Rio Tinto and Nerva. In future, instead of controlling absolutely these municipalities by means of its own nominees, the Company will be faced by hostile majorities in both townships, which are inhabited by its own workpeople, and situated within its own landed estate.

The terms of settlement have been published in the local papers; the most important concessions are the following:

1. The hours of work in the surface departments, formerly 9, have been reduced to 8½. (The strikers had demanded 8).
2. From January next the Company will inaugurate a system of pensions, to which all aged and infirm employees will have a right, instead of such pensions being granted as heretofore to only a very limited number of selected persons, as a free act of grace on the part of the management.
3. Those men who may record their objection to work for contractors will be found work directly under the Company.
4. Any man having a complaint to bring before his chief, or before the newly created board of the principal departmental chiefs, shall be entitled to the assistance of another employee from his own department to present and support his complaint.
5. All those dismissed "on account of social questions" shall be reinstated.
6. The questions of a rise in wages of 25 centimos per day all round, and of a guaranteed minimum wage of 3½ pesetas for all piece-workers underground shall be submitted to a mixed commission composed of representatives of the Company, of the men, and of the Government; who will render a decision by the first of January 1914.

As will be seen, the concessions, except the last, are of no great moment. Reading be-

tween the lines, however, Nos. 3 and 4 give sufficient indication of the legitimate cause for complaint the men must have had, and of some of the abuses that existed.

Apart from the deplorable loss of life and the loss of six weeks' production, the strike must have cost the Rio Tinto shareholders at least a couple of hundred thousand pounds. Owing to the exceptional rains that affected the province of Huelva during the latter part of October and beginning of November, most of the mines had great difficulty in saving from waste the copper liquor produced in such abnormal quantity, in spite of being able to utilize extra labour for the purpose. At Rio Tinto, owing to the impossibility of getting men to collect the copper precipitate in the ordinary way, the bulk of the contents of an abnormally large stream of copper liquor ran to waste for many days, and the loss of copper must have amounted to from 50 to 100 tons per day during several weeks. In the absence of the usual staff of workmen, members of the English staff were employed shovelling out such copper precipitate as could be come at easily, during several days, until a mob of strikers' wives and other women from Nerva came down with sticks and stones and drove them away! But the loss of copper down the river is only one item in the list of disasters. A couple of thousand iron wagons were left full of cupreous pyrites when the strike started, and most of the wagon-bodies are so eaten away as to be only fit for the scrap-heap. In addition to the fire in the Alicia shaft, which renders a section of the San Dionisio mine unworkable for some time, and to the loss of the main San Dionisio pumps, which has left all the lower workings of that mine full of water and inaccessible, the rains have caused a large amount of settlement in the South Lode mine under the town, as a consequence of which, in the absence of the usual maintenance gangs of timbermen, many of the stopes there also have collapsed, and will not be accessible for a long time to come. Taking these and a large number of smaller items into consideration, it is probable that £200,000 is a low estimate of the direct loss caused by the strike, without taking into account the loss of production.

In the opinion of those best competent to

judge, the whole business could hardly have been worse handled. On the one hand, it is probable that timely concessions would have averted the strike; on the other hand, it is certain that had the management held out for another week or ten days the men would have surrendered unconditionally and gone back to work on the Company's terms, disowning their leaders. Instead of this the management held out until they had incurred an enormous loss, and strung up to its very highest pitch the hostility of the strikers—and then climbed down from their *non possumus* attitude.

The most lamentable thing about the affair is that the whole trouble might have been avoided, and the strike prevented, by a few concessions made in time, if there had been an earnest desire to root out abuses, and above all had the management been a little more in touch, not only with its workmen, but with educated Spanish feeling outside, and with its own Spanish employees. The latter saw the storm coming, but did nothing to stave it off or warn the management, half of them because they were afraid of being discharged upon the spot if they said anything that could be construed as criticism of their English chiefs, the other half because they had become disgusted and alienated in consequence of the contemptuous treatment accorded to them for many years past by the English staff.

It is difficult for anyone at a distance to realize to how great an extent the whole Rio Tinto administration, managers, departmental chiefs, and directors, is ignorant of, and out of touch with, Spanish feeling, and how successfully they have managed to antagonize, not only their employees and workmen, but all the best elements in the district, and to forfeit by their open contempt for Spanish ideas in general and for their neighbours in particular, the esteem and sympathy of educated and influential circles in the Province. Although the whole administrative organization of Spain is rotten, the Spanish are a sensitive and in their way a cultured people, and the domineering way in which Rio Tinto runs its *imperium in imperio*, with scant regard for other people's rights and ostentatious disregard of their opinions, rankles in their minds. Their sympathy is further alienated when they see that, as in the notorious Peña case, advantage is taken of every legal subterfuge in order to carry out the ignoble policy of crushing or injuring a small competitor. Their last shred of respect for the English administration vanishes when current gossip tends to

destroy the tradition of British incorruptibility (our best if not our only claim to respect in foreign lands), and accuses English officials of taking presents from contractors.

Many of the departmental chiefs and managers of Rio Tinto have had little more than a bowing acquaintance even with the Spanish language, and know nothing of the people; for instance, there are today at Rio Tinto chiefs who have been there for 20 years, without having ever addressed any of their men in a body, or having learnt anything more about them, individually or collectively, than what the chief foremen and contractors may have chosen to say. The only manager of Rio Tinto in recent times who ever really understood the people was the late Neil Kennedy, formerly consulting engineer, now alas gathered to his fathers, and even he could never get a free hand.

CAMBORNE.

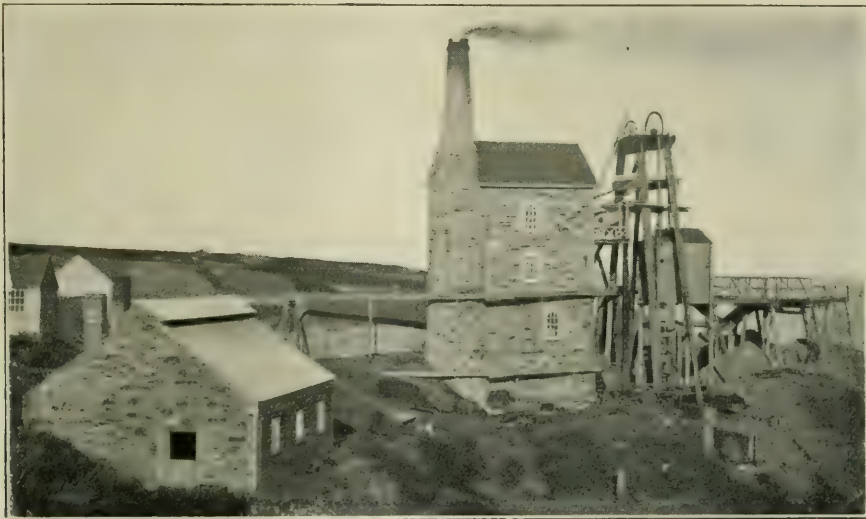
Levant.—Once again this famous mine is being worked at a loss. For the sixteen weeks ended October 25, the expenditure exceeded the receipts by £394, of which £250 went in dues to the lords. This loss, as against a profit of £1187 for the previous four months, is accounted for by the increased expenditure on wages and materials due chiefly to a larger quantity of ore being handled, to a decrease in the credit for copper, and to a drop in the price of black tin of £17 per ton, so that although the sale of concentrate was increased by 16 tons, it realized only about the same sum as the smaller quantity last time. The tonnage milled was 8117, and the recovery of black tin 32 lb. per ton as against 30 lb. last account. From the chairman's remarks and the manager's supplementary report, it would appear that unless there is an increase in the price of tin, there is little prospect of making profits, and as the chairman added, that is the present position of many of the mines. No progress appears to have been made respecting the new lease.

Goss Moor Tin Alluvials.—The accounts for the year ended August 31 show a loss of £4458. From the report of the manager it appears that the plant was working 4627 hours, from which must be deducted 236 hours occupied in running-down the boxes. For several reasons, 474 hours were lost, and it took 764 hours to float the pontoon to the various sites, the frequency of floating being due to the shallowness of the ground worked. During the period of actual work, 221,373 cubic yards of ground were treated, or ap-

proximately 50 cubic yards per hour. The recovery of black tin was 35 tons 13 cwt. or $5\frac{3}{4}$ oz. per cubic yard. Under a previous manager, very poor ground was run into, and so for the greatest part of the year, the plant was working through old tailing to get back into the main run toward the middle of the moor, where the average depth is 20 ft. It is stated that this deep ground has now been reached and that the returns are steadily increasing. The portable prospecting plant worked in three different parts of the property with encouraging results.

Dolcoath.—No doubt the fall in the price of the shares of this company is explained by

West Kitty.—Although no official information has been issued to the shareholders for many months, it is evident from the recent sales at the ticketing that the position of affairs at this mine has considerably improved. For the first four months of the current year, the sales of black tin amounted to 51 tons, realizing £7314, while for the four months ended September 30, the quantity was $74\frac{1}{4}$ tons valued at £8761, so that had there not been such a serious fall in the price, the improvement financially would have been substantial. During the latter part of 1912 and until early in May last, difficulty was experienced with water, but for the last few



WHEAL FRIENDLY SHAFT OF WEST KITTY MINE.

the general shrinkage in the tonnage crushed, the recovery, and also the price realized for the product, as is clearly shown in the following comparative figures of the first five months of the half-year ended June 30 last, and the first five months of the current six months:

months, the mine has been kept in fork and a dam has been built to hold back the water from the Thomas's and Reynolds's sections of the mines. The pumping engines on these two mines have been stopped and the water now flows into the Wheal Kitty property. It

1913	Tonnage milled	Sales of Black Tin				Recovery Lb. per ton	Value
		Crop		Slime			
		T.	C.	T.	C.		
Jan. 1 to May 24.....	47,960	592	14	58	19	30.4	£90,023
July 1 to Nov. 22.....	44,727	524	8	53	18	28.9	£63,786

This serious fall must materially affect the profit for the current six months, for it is unlikely that the working cost has been much reduced, particularly in view of the manager's forecast of increased development.

is understood that at the bottom of the mine, the assay-values are equal to what they were above, and the management is making every effort to sink the main Engine Shaft at Wheal Friendly so as to open-up the lodes in depth.

Great importance is attached to what is locally known as the New Lode, which has been intersected to the south of this shaft. It is reported to be 5 ft. wide with an assay-value of $2\frac{1}{2}\%$ tin oxide and dips in a northerly direction at approximately 30° . It is thought, however, that this lode is not a new one, but that it is a continuation of the old West Kitty lode from which such large quantities of tin were extracted in the past. It is with the view of developing this continuation, in conjunction with other lodes to the north of the shaft, that the whole efforts of the company are now being directed. To the north of the shaft, the lode, which was originally supposed to be the continuation of the West Kitty lode, is also being developed, and the assay-values obtained therefrom are reported to be satisfactory, so that the general position of the mine may be considered to be steadily improving.

The Clay-Workers' Strike.—As anticipated in my October letter the strike has collapsed, and the men are back at work, without any improvement in their conditions of service, and without having secured the recognition of the Worker's Union. There was some justification for the strike, but the men were badly led, and the methods adopted alienated public sympathy. Another effort will assuredly be made sooner or later.

Botallack.—The report issued for the year ended June 30 last does not make cheerful reading. During this period Allen's shaft was sunk 110 ft., at an average cost of £18. 8s. 0d. per foot, and the depth from surface is 1477 ft. A large amount of development work has been carried out on the No. 2 lode at the 7th, 8th, 9th, and 10th levels, and while the results in the first two have been fairly satisfactory, the lode in the 9th and 10th levels has been narrow in width and poor in value, and all work in the bottom has now been suspended pending developments in the levels above. The developments on the Narrow Lode, on which great hopes were based in view of past results, have also been disappointing. The lode was attacked at the 6th, 7th, and 9th levels, but although averaging 20 ft. wide, showed no ore of any value, nor gave indication of improvement. The only explanation the management can afford of this disappearance of ore is the change in the country rock from killas to granite. In this district, no ore of any consequence has been found in the granite, as witness the result of development at Levant. During the year, 11,980 tons from the mine and 13,208 tons

from the dump were treated, for a yield of only 131 tons black tin, or $11\frac{3}{8}$ lb. per ton.

Carn Brea & Tincroft.—The future of these mines is the topic absorbing the interest of all concerned with the Camborne mining district. All sorts of rumours are afloat, but little official information has been made public. Certain it is that the Carn Brea stamps have been stopped, and the employees discharged, the ore from Carn Brea now being hauled through Highburrow East Shaft to Tincroft and stamped there. It is persistently stated in the district that the Carn Brea section of the mines is to be closed and this is probably a reliable forecast of the recommendation made by Messrs. James Bros. in their report. The produce from this section has been very low for some time past. Many local people would like to see it drained to the bottom and the Highburrow lode vigorously developed. This was the recommendation of Forster Brown when he was consulting engineer, but it would cost a large sum of money, which for speculative undertakings of this nature is, just now, very scarce. The loss on working the mines for the sixteen weeks ended October 18 was £6731.

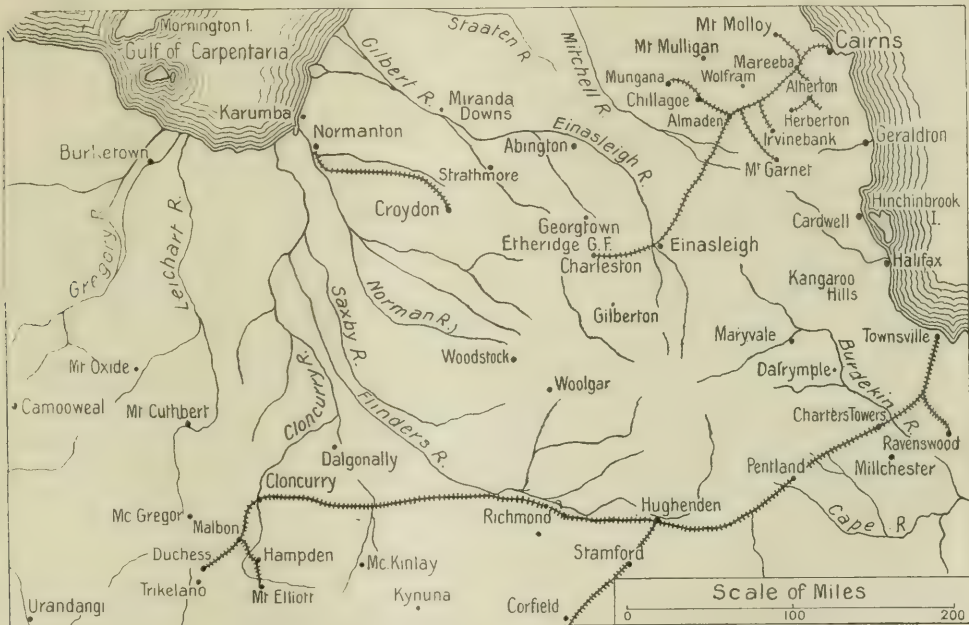
Falmouth Consolidated.—All work underground at the Wheal Jane mine belonging to this company has been suspended and most of the men discharged. It will be recalled that this company was registered on February 15, 1907, with a nominal capital of £150,000, the purchase consideration being £80,000, payable £5000 in cash and the balance in fully-paid shares. The cash subscription for working capital at the time was £44,683. Subsequently bonds of one kind and another were issued to the value of £60,000, and £20,000 was borrowed against security, so that a large sum of money has been sunk on the property. In the original equipment, ball-mills were installed, but they proved a failure, and subsequently 60 Californian stamps were substituted. The folly of having directors who know little or nothing about mining is well illustrated in this case. The chairman at one meeting declared that sufficient ore was opened up, or readily accessible, to keep 1000 Californian stamps at work, and probably there was ore of a kind available, but not ore in the true sense of the word. Again, at the meeting in February last he is reported to have said that he was confident that a working profit at the rate of about £30,000 per annum would be realized from then onward. This failure will be seriously felt in the Truro district, for 400 men were employed.

MELBOURNE.

North Queensland.—Here also mining has assumed a little brighter hue. The reason for this is not the development at the Mt. Elliott mine, but is through the striking of pyritic ore at the Hampden copper mine at a depth of about 320 ft. So far no great extent of the copper pyrite has been actually opened up, still the striking of this class of ore in the property is of importance to the company, and therefore the progress of work is being most closely followed. The company has recently installed fresh water-jackets and better returns may be looked for; still unless rain falls fairly

quantity of ore developed and to the distance of the mine from any railway. Gerald Williams (lately manager) has preceded this letter to London, and W. H. Corbould is acting as consulting engineer for the London directors.

Gold.—No fresh developments in connection with gold mining have to be reported. In Victoria the working out of some of the deep leads is still progressing, but as the slope is followed the results become less satisfactory, due to the wider stretch of the 'gutter' and the way in which the gold is dispersed. What has now become established is that it takes at least 11 dwt. per square fathom to



NORTH QUEENSLAND.

soon in North Queensland trouble with the water-jackets through the use of mine-water must recur. It is not generally recognized by investors in the Hampden mine that in the Wallaroo property of the Macgregor group a fair quantity of rich ore exists. This will be of service later when the company has established railway connection with that centre. Now that the astonishment over the terms of the Mount Oxide deal has subsided, the question is being asked, when will the company get to work on a fair scale. The Sydney shareholders are exceedingly annoyed at the way in which they have had to accept terms dictated from London. There can be no question that the capitalization of the concern is altogether too great when regard is paid to the

meet costs today, and now that Mr. Justice Higgins is interfering with the industry again, another pennyweight will be required. All the same, some of the undeveloped gutters are being prospected in the hope that they may prove to be remunerative. But only the faithful will support these ventures. In New South Wales the dredging areas are being exhausted, so that there a steady decline of the gold yield is assured, and the same condition exists in Queensland despite the additions that have been made to the output through the treatment of the copper-gold ores of the Cloncurry region. In Western Australia the output is improving a shade, but, apart from a strike at Ruby Wells, near Meekatharra, the month's prospecting has been featureless.

Broken Hill.—The striking of the lode at 1400 ft. in the cross-cut of the North mine is an event of great importance. It has to be understood of the Broken Hill district that the Proprietary company pegged out originally 3 blocks having a total length of 3000 ft. in which the ore-shoots at one end pitched south and on the other end pitched north. Following the ore-channel northward, several distinct ore-shoots are disclosed. That worked by the North company pitched into its ground from the Junction and Junction North mines. Separated from this shoot by about 300 ft. of country is the most northerly orebody yet found in the main lode. At a depth of 1200 ft. the main shoot is about 1200 ft. long and it now extends from the Junction North boundary about 900 ft. into the North mine. This is the orebody that has been struck in the cross-cut at 1400 ft. and at the time of writing it had been bored for 102 ft., the average grade being 17% lead, about 8 oz. silver, and 10% zinc. These assay-values are remarkably high for such a depth and have attracted wide attention. So far, of course, the work at 1400 ft. is in the early prospecting stage, but it is to the credit of the management that it never had the least doubt as to the lode being cut at the depth at which mining is now being conducted. Seeing that in the Junction North mine to the south the keel of the shoot had been exposed, and bearing in mind the shallow depth at which the shoots of ore in the Block 14, British, Proprietary, and Block 10 mines had cut out, some fear existed that the company might not get so large an orebody as was hoped at 1400 ft. However, it would appear that the company is going to have another big development at 1400 ft. If the orebody is of the same size as on No. 12 level, then an addition of 1,000,000 tons will be made to the reserve. In the matter of metal contents, if the ore-shoot keeps up to 16%, then the ore will be of the best grade handled at Broken Hill. It would not be right, when discussing this discovery, to ignore the equally important find made at the other end of the field by the South company. Boring from the No. 11 level, an orebody 160 ft. wide giving high assay-value has been passed through. Then at the Block 10 mine also some excitement has been occasioned by the way in which a western orebody first met on the boundary of the Sulphide Corporation's Central mine has been opening up. It would appear, therefore, as if the year 1913 is likely to promise well for Broken Hill by insuring to it discoveries of great importance from the

standpoint of increased ore reserves.

Ardlethan.—In this tin district of New South Wales a rude awakening has come to people who assumed that it was to develop into a big lode-tin mining district. A number of claims were pegged, a considerable amount of capital was subscribed, but despite the existence of rich patches, the bulk of the properties taken up have failed to develop anywhere within coo-ee of the sanguine expectations of the company promoter. It is computed that £300,000 in hard cash has been lost in Ardlethan companies during the past few months. This means that the public has rushed in to invest when the proper course was to have held off until an appreciable amount of development work had been done. The best property on the field is the Carpathia, but even it is over-capitalized. There is no denying that some of the ore-shoots are exceedingly rich, but their extent has to be demonstrated. Had investors given thought to the subject for a moment, they would have remembered that with the exception of the Vulcan, in North Queensland, there is not a lode-tin mine in Australasia that has ever stood the test of development. The real truth is that Ardlethan is suited to small prospecting companies, whereby every penny of expenditure would be watched and close attention would be paid to geological signs.

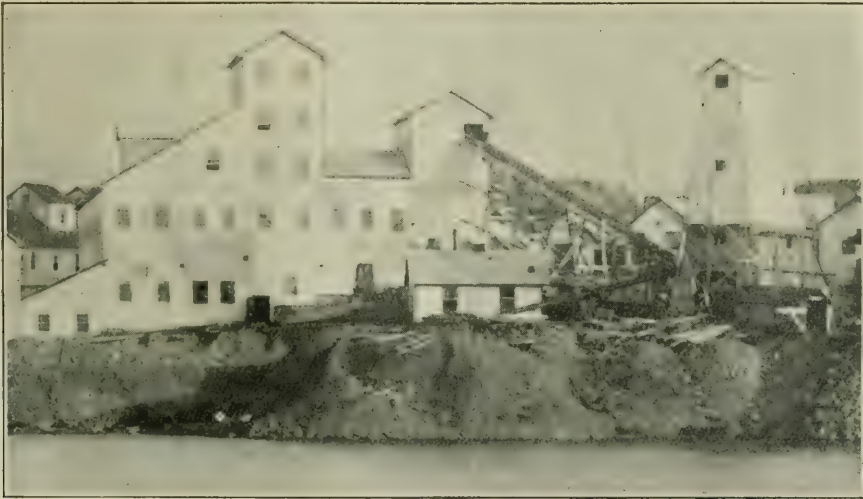
Osmiridium.—Very few discoveries of late compare in interest with that of osmiridium in Northern Tasmania. The mineral has been known to exist in the streams of that part of Tasmania for some time past, but there was no evidence of its existence in place until recently. When the news first came to hand, it was received with a considerable amount of incredulity, just as was the statement made some three years back that platinum had been discovered in place in payable quantity in Gippsland, Victoria. Work at the smelter has established beyond all question that platinum is found in Gippsland in the matrix, and now it is proved that osmiridium exists similarly in Tasmania. The district is one in which English capital was sunk some time ago near Heazelwood in a silver, lead, and copper mining venture, but unfortunately without profitable result. The country where osmiridium is found is mountainous and can only be approached by foot-track. The locality where the most progressive work is being undertaken is at Bald Hill, which can be described as being a continuous mass of serpentinized rock. W. H. Twelvetrees (Government Geologist of Tasmania) claims

that the original rock was gabbro or peridotite, and he holds to the view that the source of the osmiridium is the outside belt of serpentinized rock. He says: "Close observation has satisfied me that we have here that rare occurrence osmiridium in undisturbed serpentinized rocks. Rock in the immediate neighbourhood shows decayed whitish flakes of bronzite, having a mica-like appearance. So here, too, the matrix rock of the mineral is probably a peridotite." Some specimens taken by Mr. Twelvetrees from the rock in Caudry's mine yielded specks of osmiridium equal to 2 oz. per ton. Some of the rock in

to be an alloy of osmium and iridium has been discovered.

TORONTO.

Cobalt. — The draining of Kerr lake has proved a profitable venture for the Kerr Lake Mining Co., resulting in the exposure of a vein of plate silver. It is an extension of the main east vein, and for a distance of over 210 ft. averages about 7 in. wide. The vein has been worked on the lower levels, where it is not nearly so rich or wide as it shows on the surface. During October the Nipissing mined ore of an estimated net value of \$218,772, and



COBALT LAKE MINE, AT COBALT.

which he could detect no surface sign of the mineral, even after careful examination with a magnifying glass, gave a return equal to over 59 oz. per ton. The associated minerals are magnetite and chromite. So far, the bulk of the mineral extracted has been obtained from alluvium in the adjoining creeks and rivers, or from crevices in the rocks, but Mr. Twelvetrees personally satisfied himself as to the existence of the mineral in place. In some quarters the view is taken that certain formations of chalcedony and opaline silica are the source, but this view is not acceptable to Mr. Twelvetrees, who seems to rely on the serpentine being the original matrix of the mineral. Some fair-sized nuggets have been discovered, one piece weighing 9 dwt. This 'slug' is described as a solid nugget of clustered crystals. Another nugget weighed 6 dwt. 15 gr. and another 7 dwt. An unknown mineral which the Government Geologist believes

shipped bullion from the Nipissing and customs ore of an estimated net value of \$348,612. The low-grade mill treated 7461 tons, and the high-grade mill 180 tons of ore. At the 4th level of the Meyer shaft near the Keewatin contact a branch vein 1 to 2 in. of 2000 oz. ore has been encountered. Shaft No. 64 is being put down to the 900-ft. level. The production of the La Rose for October was 203,454 oz. of silver, and the profit \$67,927. The surplus, including the value of outstanding shipments and ore on hand, was \$1,709,579. The Seneca Superior has tapped its main vein on the 100-ft. level, where it is 6 in. wide of 1000-oz. ore. It is of a lower grade than on the deeper levels but the vein is wider. The greatest amount of work has been done on the 200-ft. level, where there is a rich ore-shoot 400-ft. long from 3 to 4 in. wide. The extension of the Seneca Superior vein on the adjoining Gould property has pinched out

after being followed for about 30 ft. The Pan-Silver, owning two claims next to the Beaver and Temiskaming mines, has recently made two good discoveries. One vein struck at the 200-ft. level 5 in. wide runs upwards of 4000 oz. per ton, with about 3 ft. of wall-rock, which will make good milling ore. A new vein recently opened up on the Penn-Canadian is yielding well, the production for October amounting to 60,015 oz. The mill has been running steadily for some months. The Temiskaming has passed its usual dividend owing to the unfavourable condition of the mine, the small patches of high-grade ore found on the lower levels having yielded inconsiderable returns. Lack of funds has also made necessary the stoppage of work on the North Dome of Porcupine controlled by this company. The Crown Reserve has declared its regular 2% monthly dividend, but did not make an extra Christmas distribution to its shareholders, as was expected. The production of the McKinley-Darragh for October was 192,749 oz., of which 60,017 came from the Savage. This is a considerable falling off as compared with September, partly due to lack of power. Rich ore continues to be produced from No. 40 vein, from which alone 43,000 oz. were taken.

Porcupine.—The steady output of this district during the current year has resulted in a notable increase of gold production in Ontario. According to returns made to the Bureau of Mines for the first nine months of the year, the production was valued at \$3,281,027, being an increase of \$2,162,692 over the corresponding period of 1912. Of this amount all but \$174,777 came from Porcupine. The output of the Dome for October showed a considerable increase, the number of tons treated being 12,370, with an average recovery of \$9'54, making a total of \$118,000. The report of the Hollinger for the four weeks ending October 7 showed a gross profit of \$131,510. The mill ran 88% of the possible running time, treating 11,850 tons of ore of an average value of \$17'39, and making an approximate extraction of 96%. About 100 ft. of driving had been done on No. 1 vein at the 425-ft. level, which showed no falling off in grade or width of ore. A winze is being sunk to 550 ft. The McIntyre has issued a statement for October, showing a total production of \$39,242 from the milling of 4131 tons of ore and 26 tons of concentrate. The assay-value of the ore treated was \$9'57, and the extraction 95%. The Dome Lake mine is likely to change owners, examinations of the

property having been made in the interests of the Hudson Bay Mines of Cobalt and the Homestake Mines Finance Co. of Porcupine. The mill has been closed down, and the only work now being done is the sinking of the main shaft from the 180 ft. level to 300 ft. An English syndicate represented by Harry Cecil has acquired from the Great Northern a three-fourths interest in the Teck-Hughes, Kirkland Lake district.

Alberta Oil.—Considerable excitement has been occasioned by the striking of oil in the vicinity of Calgary, and promoters and speculators are actively endeavouring to create a boom. Notwithstanding a warning to the public issued by the Board of Trade and civic officials of Calgary to the effect that such a movement was unwarranted, as the oil had not been proved to exist in commercial quantity, a large number of companies have been organized to place stock on the market. The Geological Survey of Canada has received a sample of the oil, which was struck at a depth of 1560 ft. by the Calgary Petroleum Products Co., about 16 miles west of Okotoks, Alberta. It is pronounced to be a 'white oil' consisting largely of gasoline and phenomenally light for a natural mineral oil. White oils are rarely found in quantity, and appear to be the result of filtration through clay strata of the lighter portions of ordinary petroleum. The commercial value of the strike so far remains unproved, but, whether oil is present in large quantity or not, the discovery is regarded as important, for white oils generally occur only in the vicinity of large bodies of ordinary petroleum.

NEW YORK.

Flotation.—Everyone interested in copper or zinc mining has been displaying a keen interest in the progress of the Minerals Separation infringement suit at Butte. The story of this is well known to your readers, as is the fact that the suit brought by the Minerals Separation against James M. Hyde was decided for the plaintiff, Judge Bourquin making such a sweeping decision that there can be little hope of getting a reversal on appeal, on technological grounds, at least. Meanwhile Minerals Separation has brought suit against the Butte & Superior, the company using the process. To this the defence was made that Hyde was not an agent of that company (being no longer in their employ) and that the process now in use was devised by F. G. Janney. The Court held that the Butte & Superior was infringing the Minerals Separation

tion process, but refused to assess the damages, on the ground that this was properly and customarily the work of a referee. The Court denied the application of Minerals Separation for an injunction to restrain the mining company from continuing to use the process, holding that thereby a large number of workmen would be thrown out of employment and that, since the Butte & Superior is financially responsible, the requiring of the filing of a bond for \$75,000 is sufficient. The Minerals Separation made a claim for \$3,000,000 damages, and asks of this company a royalty of \$1'25 per ton for the continued use of the process.

pay a royalty. It may be expected that the suit will be fought out to the uttermost limit of legal ingenuity, for the process involved is practically identical with that of the Minerals Separation, and if that company should lose the suit it would practically have no American rights left. It goes without saying, therefore, that the contest will be a fight to a finish.

Mexico.—Ever since the beginning of the revolution rumours have been current that the real conflict there was between the Standard and the Pearson interests. These have never been authenticated, and it was a source of surprise when so well informed a paper as the



FEDERAL TROOPS ENTERING SALTILLO.

These high claims are, of course, based on the fact that the infringement was wilful, the law allowing the recovery of three times the ordinary charges in the case. Meanwhile a contract has been made with the Elm Orlu on unusually favourable terms, which puts the Minerals Separation in an excellent position, as the referee will undoubtedly take this contract into account in assessing damages. The case has an aspect of larger interest, for the Minerals Separation is really arrayed against the Hayden, Stone—Jackling—McNeill—Aldrich group, which controls the Utah, Ray, Chino, and Nevada Consolidated Copper companies, in addition to the Butte & Superior. As these companies produce 120,000,000 lb. copper per year and are at present only recovering $\frac{2}{3}$ of the copper content of their ores it would be worth millions to them to be able to use the flotation process without having to

New York *Sun*, on November 24, printed several columns of a dispatch from Washington in which that position is openly taken and attention is drawn to "the significance of the British government's interest in the Cowdray oil properties in Mexico through the relations of that government to the Huerta regime." The idea underlying this is, of course, that the British navy must have a source of oil supply, owned by its nationals, for its navy, which is being converted from coal to oil firing. The only visible source of large supply of oil of suitable grade is in the Caribbean area, and the Mexican and Colombian grants to the Cowdray interests are thus supposed to possess international importance. The average man is inclined to believe that where there is so much smoke there must be some fire, and there is no doubt that the progress of events in Mexico has been directed, to some extent, by

hidden strings of self-interest. Grape-juice diplomacy is scarcely qualified to deal with so complex a situation. As to swallowing these reports, it is impossible to take them at their face value, for certainly the Boer war should have clearly indicated the unwisdom of allowing business interests to interfere with inter-racial politics. The country here is heartily sick of the whole Mexican business and views with dismay the possibility of intervention becoming necessary through unskilful handling of the situation. After fifteen years experience as nursery-governess to Cuba the United States has no desire to be forced into a similar relation toward Mexico, however convenient that might be to certain business interests. The most discouraging part of it all is that men like Taft and Magoon are now replaced by Sweeks and Pindells.

Thomas W. Lawson is off the reservation again and is now tilting against the United States Steel Corporation, with the aid of half-page advertisements in the daily papers. As usual, these consist of a flood of words in which actual ideas are with difficulty discernible. The main charge is that the dividends on Steel common cannot be maintained, and that the insiders have been unloading it upon the public ever since it sold at 95 and are still engaged in doing so. This broadside exhibited little effect in the share market beyond eliciting references to Yukon Gold, Trinity Copper, and Bay State gas. Steel common, which opened at 54 $\frac{3}{4}$, went to 55 $\frac{1}{4}$ and closed at 55 on the following day. It is alleged that Lawson is 'short' 50,000 shares of Steel common and that the prospects of his being able to secure this at a profitable figure are exceedingly dubious. The corporation has, according to a semi-official statement, an actual surplus of \$136,000,000, not including the \$203,000,000 it has expended out of yearly earnings since its foundation in property account; a total surplus of between \$300,000,000 and \$400,000,000. The Corporation has \$75,000,000 at the present time in the bank for actual working needs. The earnings of the present calendar year, including the third quarter, amount to approximately \$114,000,000, from which all interest charges for depreciation and dividends will deduct only \$82,000,000, leaving a surplus thus far of \$32,000,000. Business generally is dull and is likely to remain so for some months yet, but there seems little reason to believe that the Steel Corporation is in a more unfavourable position than other steel companies.

The Juneau district in Alaska is one of

much interest just at present. The Alaska Treadwell has always been one of the most interesting low-grade low-cost mines, and is so well known, together with the Alaska Mexican and Alaska United, that it needs no reference. These mines are on Douglas island, and the prospects on the mainland have attracted comparatively little attention until recently, when the Hayden, Stone—Jackling—McNeill interests took over the Perseverance and launched it as the Alaska Gold Mines, a big new low-cost mine, with an immense reserve of ore, a gold content of \$1'50, and a working cost of 75 c. per ton. Whether it will be possible to secure so low a working cost as is claimed by the management is open to some doubt, but costs certainly should total less than \$1 per ton. Meanwhile the Bradley interests, which are the dominant factors in the Douglas Island mines, have acquired the control of the Alaska Juneau, which adjoins the Alaska Gold Mines properties, and are proceeding to develop it on similar lines, but without the accompaniment of brass bands and stock market activity which characterizes the Hayden-Stone promotions. In technical methods the contrast will probably be equally as great, for practice at the Bradley mines adheres to the customary stamps for crushing and the use of tube-mills for re-grinding, while the Jackling mills use crushers and rolls for preliminary reduction, and re-grind in Chilean mills. A third note is added by the advent of the United States Reduction, Refining & Mining Co. into the district by securing an option on the Ebner, which adjoins the Juneau. Little is known of this property, which is held by the Alaska-Ebner Gold Mines Co., a reconstruction of the California-Nevada Copper Co. This company owns a copper mine at Pioche, Lincoln county, Nevada, known as the Bristol Consolidated, and another copper property in Madera county, California, neither of which seems to offer much promise. The company mortgaged these in order to acquire the Ebner, and may thereby recoup itself, as the United States company will doubtless pay a round sum for the property if the exploratory work that it agrees to perform under its option, which extends to March 1916, proves to be as satisfactory as hoped.

The Water-Power of Alaska promises to become of importance in other ways than supplying power to the mines. In investigating the resources in this direction for the Alaska Treadwell and the newer groups of properties on the mainland, several engineers

have become impressed with the vast possibilities. In particular, W. P. Lass and E. P. Kennedy have in hand the utilization of the water of the Speel river, at a spot about 30 miles east by south of Juneau. A number of lakes are above this river, or rather inlet, and are fed from the glaciers beyond. In the case

the manufacture of nitrogen products from the air. The region is suitable also for sulphuric acid works, as supplies of pyrite are plentiful. The wood-pulp industry might be established to profit. Mr. Lass has gone thoroughly into the project from the chemical side, and Mr. Kennedy is an authority on hydro-electric details. More will be heard of this project before long. In the meantime it may be remarked that here again is an instance of mining men turning their attention to businesses possessing more than wasting assets.

JOHANNESBURG.

The Messina is the only producing copper mine in the Transvaal, and is situated in the extreme north of the province, almost on the borders of Rhodesia. It has had a hard uphill fight on account of its inaccessibility, and little interest has up to the present been taken in it; now, however, it is the rail-head of the Pretoria-Pietersburg line, and the situation has completely changed. The company has a capital of £250,000 in 1,000,000 shares of 5s. each, of which 661,804 are issued, and debenture obligations amounting to £250,000 at 6%. It owns the farms Vogelsang, 6646 acres, Tempelhof 7763 acres, and Maryland 6265 acres, and has leased the farm Berkenrode, on which the present mine area of 1758 acres has been located, for 99 years. In consideration of the benefits to accrue from the advent of the railway it has an arrangement, whereby it guarantees for 10 years any loss in working the extension, not to exceed 4½% on a cost of construction up to £426,831. During the year ending June 30, 1913, 22,601



of Long lake, 10,000 horse-power could be generated without the construction of a dam. This could be easily increased by damming the waters of the upper Speel river to 100,000 h.p. The head of the inlet affords ground for an extensive works and settlement, and access by sea is all that can be desired. Mr. Lass has in view the establishment of a plant for

tons were crushed, 3602 tons of concentrate averaging 45·8% were shipped to Swansea, and realized £93,786, and the gross profit was £29,734. After allowing for debenture interest, the amount to credit of share premium account, and the adverse balance of profit and loss, there remained a balance of £401 at credit. The fully developed ore reserves

amounted to 230,000 tons of an average value of 10% copper, against 170,000 tons of the same value at the end of the preceding financial year. The original concentrating plant, which deals with 50 tons per day, is still running, and a new plant to treat 250 tons per day was recently started, and is giving excellent service. This latter plant includes sorting-belt, rolls, breaker, trommels, jigs, classifiers, Huntington mill, Wilfley tables, and Frue vanners. In addition to these two concentrating plants there are two reverberatory furnaces engaged in the work of concentrating the accumulated middling, assaying 14% copper, into a 50% matte. The formation consists of granite, both grey and red, which is frequently of a gneissic structure. There are three lodes, called the North, Middle, and South, striking NE-SW and dipping SE at from 70° to vertical. The ore consists of glance, bornite, and chalcopryrite. The North lode has been proved along the strike for a distance of 1500 ft., and the rich shoot in this lode has been developed to a depth of 900 ft. The company owns its own coal mine alongside the railway 25 miles distant, and though the coal is not of a good quality, it is sufficiently so for the purposes of the plant. Concentrate is now being shipped at the rate of 700 tons per month, and it is hoped to increase this soon to 1000 tons per month, averaging between 40 and 50% metal. What the annual working profit is likely to be depends, of course, largely on the price of copper, but it seems certain that under present circumstances it will be a handsome one. This mine is the pioneer of the wild northern Transvaal; and that not only in mining, for its well laid out and comfortable little camp is an oasis of civilization. From now on its real commercial progress begins, and with it, let it be hoped, the development of this extensive copper belt.

Ventilation of our mines is being eagerly discussed by the 'Chemallurgicals' and the 'Safrengineers,' and beautiful theories regarding the flow of air are being monthly slaughtered by ugly facts. Shocks are being administered all round, as if the subject had a live wire running through it, and the mining houses are getting expert technical advice for nothing. The matter has become prominent none too soon. In numerous cases the inefficient system of natural ventilation is still relied upon; where fans have been installed the lay-out has in some instances been amateurish; and the control and distribution of air currents in the workings is rarely, if ever,

regulated in a workmanlike manner. It is suggested that a properly constituted Ventilation Board, composed of thoroughly practical men, should be appointed to enforce the provision of artificial ventilation where required, when such does not exist, and, generally, to take such steps as will put this increasingly important health measure on a sound footing.

The Simmer & Jack is beginning to show signs of age and seemingly the best days of this fine old mine are over. Results for the past two years are as follows:

	Year ended June 30, 1912	Year ended June 30, 1913
Capital	£3,000,000	£3,000,000
Tons milled	863,500	912,200
Yield per ton	24s. 1d.	21s. 5d.
Cost " "	11s. 10d.	11s. 1d.
Profit " "	12s. 3d.	10s. 4d.
Total working profit	£529,944	£471,954
Dividend	15%	15%
Fully developed ore reserve, mine tons	3,033,000	2,524,000
Value per ton, dwt.....	5'57.	5'40

The low working cost is highly creditable, and does not offer much scope for further reduction, and there is little hope, therefore, of counteracting the continued droop in the value of the reserve and the yield per ton. Moreover, the time is rapidly approaching when there will be a considerable diminution in the quantity of ore derived from the outcrop and upper levels, where a great amount of footwalling and pillar extracting has been going on, furnishing a large and cheaply obtained tonnage. This deprivation will compel all the ore to be drawn from the lower levels, with probable consequent increase in working cost and decrease in profit. Sand-filling with current residue has been adopted for some years, the thickened pulp being lowered into the mine through an old disused incline shaft and two boreholes.

The Mines Trials Committee is to be wound up at the end of this year, and so will terminate a co-operative institution which, with better luck, might have been of the greatest benefit to the industry. The committee was formed for the purpose of co-ordinating and financing experimental work and for conducting trials, considering suggestions, making investigations, and generally looking into anything that held out any promise of improvement in mining and metallurgy. Unfortunately there arose a difference of opinion regarding the constitution of the sub-committees, and certain wealthy groups withdrew their representatives, thus throwing an increased burden of expense upon those who remained faithful. Money being tight,

the participating houses did not view this additional strain upon their bank balances with favour, and as the work of the committee had not resulted in the discovery of any process or appliance of outstanding merit it was decided to close down. It is greatly to be regretted that such a decisive step should have to be taken, for the creation of the committee indicated a growth of enlightenment which its failure to realize expectations may effectively retard.

pegging, and as the conditions are favourable to easy working a rush of diggers has taken place. The scene at the pegging was reminiscent of California in forty-nine, or the stampede to Klondyke, but in a South African setting containing little resemblance to either, or to the lovely Irish scene immortalized by Balfe. People of the most diversified types negotiated the dusty road from Taungs by every means from their own flat feet to motor-cars, according to the level of their finances



THE MESSINA MINE.

Killarney, a name teeming with romantic associations, has suddenly leapt into public attention throbbing with the excitement of diamond digging. But a few weeks ago this farm on the Harts river, 22 miles northeast of Taungs station in Bechuanaland, was unknown outside of its somnolent neighbourhood; now it boasts a population of 7000, and a busy hamlet composed of nondescript habitations has sprung up like a mushroom in the night. Hope street is the Regent street of Killarney. It is one quarter of a mile long, has 50 business establishments, and a roadway 6 in. deep in dust. The reason for this disturbance of the dreaming veld is that an area of 700 morgen (1 morgen equals 2'117 English acres) containing about 35,000 available alluvial diamond claims, each measuring 60 ft. by 30 ft., has been thrown open for

and their status in society. As the final words "God Save the King," which mark the official opening of a field, left the lips of the Claim Inspector, the broad line of shirt-sleeved, sunburnt, expectant diggers, each grasping four wooden pegs, broke and surged forward over the ground proclaimed open. The pick of the area was soon bristling like a badly-shaved chin, each certificated digger being allowed to peg one claim to which he can add five more claims in a week's time. Disputes were few, and soon amicably settled. The greatest good humour prevailed throughout. An hour after the pegging a 3 $\frac{3}{4}$ carat stone was taken out of the gravel and sold for £2. 10s. Probably the prizes will be few, and the blanks many, and it is a rough life though generally a healthy one, the absence of sanitary precautions permitting. The owner

of the farm bought it four years ago for £4500, and as he receives half the licence money he accepts the intrusion of this heterogeneous mob of fortune-seekers equanimity.

The Nourse earned its highest working profit during the 11 months ended June 30 last, even when compared with the profit earned during previous periods of 12 months, and paid out a dividend equivalent to 20% for the full year as against one of 15% for the year preceding.

	Year ended July 31, 1912.	11 Months ended June 30, 1913.
Issued capital.....	£827,821	£827,821
Tons crushed.....	609,250	577,700
Yield per ton.....	30s. 6d.	30s. 2d.
Cost per ton.....	22s. 6d.	21s. 4d.
Working profit per ton.....	8s. 0d.	8s. 10d.
Total working profit.....	£253,233	£260,508
Amount of dividend distribution	£124,173	£151,767
Ore developed during period,		
tons.....	693,893	512,700
Ore reserve, tons.....	1,513,980	1,421,200
Value of reserve per ton.....	28s. 7d.	28s. 2d.

The ground continues to be very disturbed and this accounts for the decline in the reserve tonnage in spite of the fact that additional development was done. Below the Goch dike, in the South Nourse section, results show a considerable falling off; and should this discouraging feature continue, it will exercise a very adverse effect on the future of the mine. For October last the results were: Tons milled, 49,800; yield per ton, 28s. 11d.; cost per ton, 20s. 10d.; profit per ton, 8s. 1d., and total working profit, £19,679. This profit is equivalent to one of £236,148 for the year, a figure which points to the likelihood of a reduction in the dividend.

Working profit is a phrase deserving to be bracketed with the word 'parable,' the little boy's definition of which is "A heavenly story with no earthly meaning." In arriving at the real working profit it is customary to lop off 2s. 6d. from the working profit per ton milled to cover capital expenditure, profit tax, and other items not included in the working cost. Applying this rule to the returns of certain companies for the month of September, it would appear that several mines are in an extremely precarious position:

	Working profit, per ton, milled.	Working profit per ton, milled.
New Riverfontein.....	£598	5d.
Princess Estate.....	£1044	1s. 0d.
Illovo.....	1046	1s. 1d.
Knights Deep.....	2879	1s. 1d.
Emmarentia U. M. Reef...	1640	1s. 7d.
Lampson's Estate.....	2116	2s. 3d.
Vogel's Estate.....	1686	2s. 7d.
Knight's Reef.....	717	2s. 3d.

An iron industry in the Transvaal is a development that holds out hopes of coming within the range of profitable economics, as evidenced by the purchase by Lewis & Marks of the farm Kromdraai for the sum of £8000. This farm, which is situated 16 miles east of Pienaar's River station, on the Pretoria-Pietersburg line, contains a valuable deposit of iron ore. The deposit consists of two massive beds 30 ft. thick, separated by a quartzite bed 30 ft. thick, dipping toward east at the low angle of 8°, and having an ascertained length of strike of 4½ miles. The bulk of the ore is hematite and specularite, containing about 80% of ferric oxide with little or no titanium or other element that would interfere with blast-furnace practice. The erection of blast-furnaces of a design suitable for South African coal is now under consideration, but it has not yet been decided whether these shall be erected at Kromdraai or added to the plant of the Union Steel Corporation at Vereeniging, where the existence of cheap power and coal offers exceptional facilities for the finishing processes. This important and recent discovery was not mentioned in Mr. Harbord's not very encouraging report, and the find considerably changes the aspect of affairs regarding iron smelting.

The gold output of the Transvaal for October was 718,431 fine ounces, as compared with 706,186 ounces for September. Labour shortage is being felt more severely than ever. The number at work in the gold mines is now 148,882 as compared with 207,733 in March and 182,058 in October last year. Some of the mines are feeling the shrinkage very severely. Since March the Crown Mines have lost 1895 natives or 36·8% of the force then employed; the Brakpan has lost 1100 of its former strength, and has had to fall back on its wide low-grade stopes in order to keep the mill going; the Knights Deep has had to close down one section of its mine and discharge a number of employees. Altogether the native labour position is in a very unhappy way and industrial cheerfulness is at a premium. Twenty-two mines declared yields exceeding 12,500 ounces, an increase of two over last month. The mines which showed yields over £100,000 were:

	Tons milled.	Fine ounces.	£
Crown Mines ...	175,000	59,980	254,779
Randfontein.....	197,681	59,609	253,203
E. R. P. M.....	138,100	53,620	227,763
Robinson.....	53,500	23,973	101,831
Ferreira Deep...	52,910	23,906	101,546

The gold output this year will probably show a decrease of some 220,000 ounces.

DREDGING IN PORTUGUESE EAST AFRICA.

By C. T. NICOLSON.

GOLD dredging has not played an important part in the exploitation of Africa, but mining men throughout South Africa are taking a keen interest in the work of the Andrada Mines Co., a company that is now erecting a $7\frac{1}{2}$ cu. ft. gold dredge in the Revue valley, about four miles from Macequece, which is the centre of the mining district of Portuguese East Africa. This dredge, which is being built by the Bucyrus Co., has a steel hull. The machinery will be electrically driven and equipped to dig to a depth of 25 ft. below water-level. The boat

Melbourne. Before the dredges arrived on the property, it was discovered that the ground for which they were built contained no gold, so a new place had to be found, and they were put on the Muza river, about 16 miles from Macequece. These boats only operated for a period of two weeks. They were not designed for the particular local conditions, and could not dig material containing large boulders. They were eventually sold for less than £100, to satisfy a debt. It is also interesting to note that this Muza river property was carefully prospected for dredging purposes



SMALL DREDGE ON MUZA RIVER, not now at work.

can be operated either by head-line or on spuds. The equipment is of the latest design used in California, and will start digging about November 1, 1913. The same company is responsible for the only other active mining work in Portuguese East Africa, namely, those at the Braganca mine, at Chimegi.

Their electrical plant, though small, furnishes power for their present operations, but a new plant to generate 1000 h.p. is being built on the Inhyamucarara river, a point about 18 miles distant from the dredge, where they have a good supply of water and a head of 950 feet. The only previous attempt to dredge in this part of Africa was made in 1903 by the Mazoe Dredging Co., with two small machines with buckets of $2\frac{1}{2}$ cu. ft. capacity, built in

this year, and found to be of no value. No large alluvial deposit of economic value has been found here, though considerable prospecting has been done during the past three years, and it is doubtful if further work will be carried on along these lines until the success of the Andrada dredge is assured.

Native labour here is of the same class as in many other parts of Africa, but such white labour as is obtainable is inferior, and any company operating in these parts would find it advisable to send their entire crew of skilled operators from abroad. The wages paid for common white labour is 18s. per diem, and 23s. to 25s. for skilled labour. The latter is difficult to get, as good mechanics stay in the better parts of Rhodesia and on the Rand.

PERSONAL

J. A. AGNEW left on December 13 for Nicaragua.

H. E. ARROWSMITH has come to London from Parral, Mexico.

RICHARD M. ATWATER was here on his way from Berlin to New York.

M. W. VON BERNEWITZ, of the *Mining and Scientific Press*, has been making an investigation of gold-dredging districts of California.

A. G. M. BEVAN left on November 19 for Liberia, West Africa.

R. S. BLACK, the manager of the Kalgurli mine, is here from Kalgoorlie.

H. KENYON BURCH, of the Inspiration Copper Co., is now at Greenwich, Connecticut.

E. J. CARLYLE was recently at Anaconda.

W. A. CARLYLE has returned from Northern Rhodesia.

F. CLOSE is in the Caucasus.

L. MAURICE COCKERELL, lately in Chihuahua, is in London.

B. I. COLLINGS, from Salisbury, is on his way back to Rhodesia.

T. W. TEAGUE CURNOE, manager for the Benue Syndicate, is expected from Nigeria.

FRANCIS J. DENNIS is a visitor from California.

JOHN H. DOWE is here from Nigeria.

THOMAS A. DOWN is back from Portugal. DAVID DRAPER is visiting Cornwall.

J. F. B. ERDLETS is in Austria-Hungary.

A. J. EVELAND has opened an office at 42 Broadway, New York.

S. H. FORD, manager of the Abbontiakoon, has arrived from the Gold Coast.

F. C. GOODWIN has obtained a post with the Naraguta Tin Mines, in Nigeria.

FRANK GRIFFIN sailed by the *Mauretania* on December 6.

HARRY D. GRIFFITHS is in Burma.

C. S. HERZIG is due from New York.

L. F. S. HOLLAND has returned to Telluride, Colorado, after inspecting mines in Utah.

H. C. HOOVER is on his way to San Francisco.

AUSTIN Y. HOY is going to the United States for the holidays.

CHARLES JANIN is at Florence.

H. I. KEEN is at St. Petersburg.

R. B. LAMB, of Toronto, was at Cobalt during November.

ERNST LICHTENBERG has returned from Canada.

ARTHUR LLEWELLYN sailed for Australia on November 20 to inspect properties for John Taylor & Sons.

W. J. LORING has returned from California.

V. F. STANLEY LOW sailed for Burranga, New South Wales, on December 13.

A. M. MACKILLIGIN left on December 6 for western Canada.

H. F. MARRIOTT has returned from Pres-tea, West Africa.

GEORGE CHESTER MASTER has received an appointment with the Naraguta Tin Mines in Nigeria.

GEORGE V. MICHELL is returning to Northern Nigeria.

F. W. NOBS, the manager of the Leonesa mine, Nicaragua, has been at San Francisco.

F. DANVERS POWER has arrived from Sydney.

C. W. PURINGTON is at St. Petersburg, returning next week.

ROBERT M. RAYMOND is at Los Angeles.

E. J. RICHES has returned from Turkey.

LOUIS D. RICKETTS passed through London on his return to America.

W. R. RUMBOLD has returned from Nigeria.

W. J. SHEPARD, manager of the South Bukeru, is here from Nigeria.

EDWARD SKEWES is manager of the Mulberry mine near Bodmin.

AUBREY STRAHAN succeeds J. J. H. TEALL as director of the Geological Survey of England.

E. HOGAN TAYLOR is home from Sumatra.

W. F. A. THOMAE sails for Marble Bar, Western Australia, on January 2.

H. BISSELL THOMAS, on his return from Siberia, is at the Russo-Asiatic Company's office.

EVAN TULLOCH left for Rhodesia on December 19.

SCOTT TURNER is leaving for New York, to spend his holidays in Michigan.

F. G. WHITWORTH is here from Cobalt.

The Old Freibergers Society held their semi-annual dinner on December 4 at the Imperial restaurant, Regent street, W. Sixteen members and one guest were present. Mr. Edward Hooper, the president, occupied the chair. The evening was enlivened by the singing of old German *Kommerslieder*, and was thoroughly enjoyed by all those fortunate enough to be present.

ANALOGIES BETWEEN THE DIAMOND DEPOSITS OF BRAZIL AND SOUTH AFRICA

By DAVID DRAPER

THE mineral known as kimberlite is now the recognized diamond-bearing rock.

Whenever kimberlite occurs, there the diamond-seeker hopes to find the gems that will reward him for his labour. The bulk of the diamonds which find their way to the dealers in Europe and America are taken from the kimberlite pipes of South Africa.

When diamonds are found in alluvial gravel in any part of the world, they are generally accompanied by certain satellites, which are abundant in the diamond-bearing kimberlite pipes. In every alluvial diamond-field this rule holds good, though in some parts of the world the satellites are less abundant than in others. The recognized minerals that accompany the diamond are pyrope garnet, ilmenite (called 'carbon' in South Africa), perovskite, olivine, chrome diopside, vaalite mica, zircon, and phosphatic minerals known in South Africa as 'bantams' and in Brazil as *favas*. Some of these minerals are found in the alluvial diamond-bearing gravels in Borneo; most of them accompany the diamond in Brazil; in the Australian washes, and in the diamond-bearing sand of German West Africa, they are reported to have been found. It would therefore seem justifiable to assume that all alluvial diamonds have been derived from the disintegration of a similar material, and that they were originally brought to the surface in pipes or fissures filled with kimberlite; but hitherto, with the exception of the deposits in Arkansas, no kimberlite containing diamonds in economic quantity has been found outside the boundaries of the Union of South Africa, and there only in the territories lying north of the Orange river. Though there are many pipes and fissures south of the Orange, they are all extremely poor. As yet kimberlite has not been found in Brazil, but there is no doubt that the diamonds in the alluvial washes have been derived from a similar rock. The *cascalho* of the Brazilian diamond digger closely resembles the 'gravel' of the Vaal in its general appearance, though it does not contain such a quantity of agates. Garnets are almost absent in many of the Brazilian rivers, but ilmenite is fairly plentiful, and in some parts perovskite combined with magne-

tite is abundant. The gravel in both countries forms terraces flanking the water-courses, and sometimes at a high level above the present streams. Diamonds are found in both countries in those ancient gravels, now covered by a considerable thickness of newer alluvium devoid of diamonds. In South Africa the alluvial diamond deposits are confined to the one great valley of the Vaal, where the wash extends for many miles into the surrounding country, especially on the northern side of the river. In the Orange and Caledon valleys no diamonds have been found. In Brazil most of the rivers, rising on the great plateau that separates the waters of the Parana and San Francisco from the Amazon, have yielded diamonds, yet in many cases a small river may be found to be associated with diamond-bearing gravel, when a larger one running parallel with it and not far distant is barren. This indicates that the diamonds are derived from isolated sources, and not from a general diamond-bearing wash spread all over the country which has been concentrated in the river valleys, the original theory of the origin of the Brazilian diamonds.

The river washes, in both Brazil and South Africa, whether diamond-bearing or barren, are naturally all of geologically recent date, but as both the continents are similar in geological structure, and both consist very largely of Triassic formation, it may be taken for granted that the eruptions of kimberlite are post-Trias in Brazil, as they are in South Africa.

There is, however, one diamond-bearing deposit in Brazil that bears an exceptionally close analogy to a South African occurrence, and that is situated in the upper portion of the Bagagem river valley, in the state of Minas Geraes, and is known as the Agua Suja diamond mine. The diamond-bearing bed consists of a layer of bouldery conglomerate, composed entirely of rocks existing in the immediate vicinity of the mine, and especially in the beds below the conglomerate, but rare in other parts of Brazil. The surrounding country consists entirely of granite and schist, yet the boulder bed is made up of a very small proportion of these rocks; on the other hand,

it contains over 90% of basic igneous rocks, such as are found intrusive in the underlying granite, where the diamond-bearing conglomerate has been removed. The diamonds are found in the cement between the boulders, which consists of a red greasy clay. In this cementing matter pyrope garnet and perovskite are abundant; ilmenite is in fair quantity; and small fragments of olivine accompany the diamonds. The late Dr. Hussack reported the discovery of fragments of eclogite in the Agua Suja conglomerate. The diamonds are of most excellent quality, and in quantity sufficient to yield a good profit under efficient and economic management. The minerals mentioned above are identical with those known as the satellites of the diamond in South Africa, and as the Agua Suja deposit is situated in a very small valley, at least 400 feet above the Bagagem river, where no evidence of the previous existence of a river can be observed, this deposit must be accepted as of local origin and no doubt derived from the destruction of basic igneous rocks, situated in the valley, by later eruptions, which at the same time introduced the diamonds and other minerals into the cementing matter.

The occurrence of large masses of impure opal in the conglomerate, and the opalization of the underlying rocks, together with the profound weathering of the entire mass, points to hydrothermal action, and this is probably the force which, breaking up the underlying beds, introduced the cementing matter bearing its precious load into the conglomerate. Up to the present this is the only diamond deposit discovered in Brazil that appears to be intimately associated with a kimberlite pipe.

The description of the mineral from the Sopa mine as given by Dr. F. H. Hatch, and published in the directors' report of that ill-starred company, dated June 30, 1912, does not agree with that from any other diamond mine either in Brazil or elsewhere. None of the known satellites of the diamond were found in the Sopa mineral. On the contrary, the deposit was largely made up of "silicious minerals, quartzite, vein quartz, tourmaline, quartz vein-stuff, and a small portion of steatite or soapstone." The concentrate consisted of "zircon, zinc-blende, galena, iron pyrite, chalcopryrite, rutile, tourmaline," nearly all minerals unknown in a kimberlite pipe. As Dr. Hatch states, the soapstone may probably represent a decomposed olivine rock, but there does not appear to have been any quantity of the mineral. The age of the Sopa deposit, according to Dr. Derby, is either Silurian or

Cambrian, and as the conglomerates of the Transvaal (Witwatersrand beds), generally considered to belong to one or other of these systems, are known to contain diamonds, though in minute quantities, it is possible that there is some analogy between the occurrence of diamonds in these two far distant deposits. The diamonds found in the Witwatersrand conglomerate have a greenish tinge similar to that of the Sopa diamonds.

The discovery of diamonds in beds of Silurian or Cambrian age indicates that there were other, and far more ancient, sources from which these gems were derived, than the kimberlite pipes of the Trias. And why not? The element carbon would crystallize under favourable conditions just as readily in the one geological period as in any other.

Brazil is only scratched, not prospected. In the days of slave labour, primitive methods for dealing with the diamond-bearing material were in use. These are still in operation. The *garimpero* or fossicker has not kept level with the times. Modern methods of prospecting are wanted, and if these are intelligently carried on, diamond-bearing pipes will be discovered in Brazil without a doubt.

Gold Imports into India.—The following figures have been taken from a circular published by Samuel Montagu & Co. relating to the imports and exports of gold into and from India during the last ten years:

Year	Gold		Silver. Net Import
	Import	Export	
	£	£	£
1902-3 ...	8,794,000	2,951,000	4,638,000
1903-4 ...	13,431,000	6,810,000	9,102,000
1904-5 ...	14,541,000	8,070,000	8,841,000
1905-6 ...	9,838,000	9,527,000	10,842,000
1906-7 ...	12,355,000	2,451,000	16,004,000
1907-8 ...	13,835,000	2,256,000	12,879,000
1908-9 ...	5,602,000	2,699,000	8,045,000
1909-10 ...	16,687,000	2,234,000	6,297,000
1910-11 ...	18,595,000	2,609,000	5,753,000
1911-12 ...	27,662,000	2,489,000	3,358,000
	141,334,000	42,096,000	85,699,000

As a rule the gold exported from India consists of the bullion produced at the mines, but the figure was swollen during the years 1903 to 1906 by exports following the extensive purchase of silver for coinage purposes. The table also gives figures representing the net import of silver during the same period. The increase in gold imports and the decrease in silver imports during the last three years are strikingly compared.

THE VOLATILIZATION PROCESS

A Record of Experimental Work at the Gwalia Consolidated Gold Mine.

By BEN HOWE.

THE successful treatment of the ore in the Gwalia Consolidated mine remains yet to be accomplished. The orebodies in this mine are among the largest in Western Australia, with contents averaging 9 to 10 dwt. gold per ton. Mining is simple. There is fuel in the neighbourhood; and labour, though expensive, is good; yet the company today is in liquidation owing to metallurgical difficulties.

Essentially the ore is a silicate of alumina intersected by veins of quartz and calcite. Iron occurs mainly as pyrrhotite, and there is about $1\frac{1}{2}\%$ of arsenic, and $\frac{1}{2}\%$ of antimony. The sulphur contents are about 2 to 3%. The mineral matter is so finely divided that all concentration processes have, so far, failed; while owing, no doubt, to the arsenic and antimony, a better extraction than 75% of the gold cannot be guaranteed by cyanidation after roasting.

During the past twelve months I tried the volatilization process on this ore. Experiments in the laboratory, and later in a furnace treating one ton per day, were most successful, with promise of evolving into a thoroughly practical and economic process. Briefly stated, the method consists in roasting the ore with a small addition of salt, whereby the gold and other metals are volatilized and pass off as fume. The fume is drawn through water and so absorbed, the base metals passing into solution, while the gold is left as an amorphous powder floating in the solution. This absorption water is pumped through a filter-press before being returned to the plant to attack more fume. The gold slime remains, of course, in the filter-press, from which it may be removed at any time for subsequent treatment.

A careful test was made on a parcel of ore put through the small furnace, which ran continuously for 83 hours. The test was watched by Messrs. W. A. Macleod and W. B. Blyth, representatives of Bewick, Moreing, and Mr. Harley Wright, representing Hooper & Speak. All parties reported this small plant to be quite successful. The volatilization of the gold over this period averaged 92%, according to the assays of the headings and residues; and the gold actually recovered was within a few per

cent of this figure. More could not be expected from an experimental furnace working on such a small lot of ore.

Unfortunately, owing to unfavourable conditions pertaining to the mine, complete success was not attained when a large furnace was installed. The trouble lay not in the volatilization of the gold—this was readily accomplished up to well over 90%, but in the absorption of the fume. The large furnace was lit on May 13, gas-firing from a wood-producer being employed. No one on the mine had any experience of this form of firing, and a month was lost in getting the wood-producer into working order for the particular conditions. No further trouble was ever experienced with this end of the plant, and in the middle of June attention was turned to the fume collection.

We were working with much unskilled labour in an isolated district, and were lamentably short of money. How slow and difficult experimental work is under these conditions can be well imagined. We made a serious mistake with this large furnace in not sticking to a method of fume collection similar to the one we had employed on the small furnace. We thought we could collect the fume equally well, and much easier by another method; but we found that our new method, for reasons which soon became apparent, was a hopeless failure. Unable, owing to our financial position and our isolation, to discard the new plant for an enlargement of our first plant, which we already knew worked well, we had to try and adapt any old thing on the mine to the erection of a gas-absorption plant. Moreover, we were denied that calm consideration and patient observation so essential to the research worker, for our funds were running out and we had to experiment against time. In our critics, whose advice the directors took, there was lacking that sympathy and enthusiasm so necessary for pushing a new process through its early stages. Under these trying conditions we worked at the problem from the middle of June to the middle of August, and then at the end of that short period we were told that "the process had had every chance," and that we must cease experiments.

I have written thus of the conditions under which we were experimenting before describing the experiments themselves, hoping to show that the abandonment of the process at the Gwalia Consolidated was due not to any defect inherent to the process itself, so much as to the adverse conditions, local and financial, under which we laboured. This is important. Failures in new metallurgical processes may be due to purely local causes, and if so debited they should not deter trials in a locality where such causes would not operate, and where complete success might be achieved.

The laboratory tests to determine the suitability of an ore to this process have already been fully described in this magazine for March 1913, and it is, therefore, not necessary here to go further into the description of these experiments.

After success had been demonstrated in the laboratory, a small furnace and absorption-plant capable of treating 100 lb. per hour, was erected. A diagrammatic sketch of this plant is shown on the opposite page.

This small plant consisted of a rotary brick-lined furnace 13 in. diameter inside and 72 in. long, fired by a kerosene and hot-air burner. The furnace made 1 revolution per minute and had a slope of 1 in. per six feet. The ore, previously mixed with 5% salt, was fed regularly by a screw-conveyor into the cool end of the furnace. This end was connected to a small dust-chamber, which in turn joined on to a 200 gal. iron vat. To avoid the trouble of fitting an air-tight top to this vat, it was placed upside down in a water seal, and made air-tight thereby. The vat was fitted with three compartments similar to a 'zinc-box,' each compartment carrying 4 in. deep of broken quartz. The bottom lips of the compartment partitions dipped about one inch under water, so that the fume in its passage through the box had to bubble through water, the broken quartz assisting in the breaking-up of the water and the gases. After this vat the fume was made to traverse a long box, also arranged like a 'zinc-box,' but with an air-tight lid. This box had nine compartments, 8 by 8 by 12 in. each, filled with broken quartz; the lower lips of the partitions dipping half an inch under water. In this way the gases had to bubble nine times through water before reaching the cylindrical receiver. This receiver served merely to catch any drops of water mechanically carried in the draught, the finer drops being caught in a square box filled with twigs and oakum. The draught was created in the furnace, and the fume

drawn through this rather elaborate system of washers by a vacuum-pump connected to the back of the oakum box. A vacuum of $1\frac{1}{2}$ to 4 in. of mercury, according to the height of water in the 'zinc-box,' was required for the suction of the gases through the plant.

No volatilization takes place if the ore and salt are heated together with exclusion of air. Air is absolutely necessary for the reaction, and it is, therefore, only in the thin layers of ore immediately exposed to the air that volatilization takes place. As a rotary furnace is turning round the ore gradually creeps up the side of the furnace until it falls over on itself, ever exposing a new thin layer to the action of the air. These are the ideal conditions for good work, and they cannot be obtained in a reverberatory form of furnace worked with rabbles, because the sticky nature of the ore (due to the molten salt) prevents the rabbles turning the ore over easily. This slight stickiness of the ore eliminates that great objection to all rotary furnaces, namely, dusting.

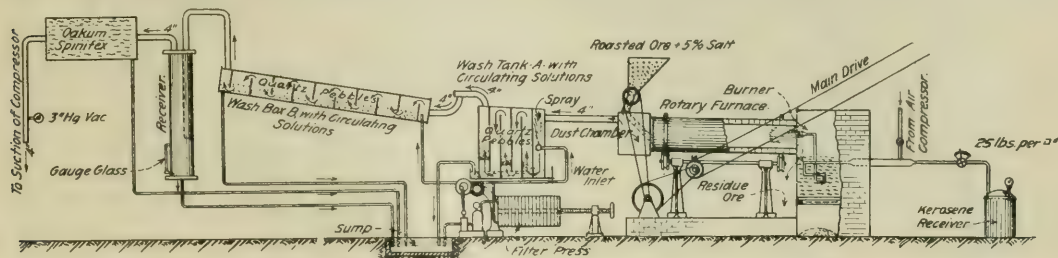
The cold ore mixed with 5% salt is fed at the back of the furnace, and advances slowly to the front or hottest part. It soon commences to roast, passing through the 'running' to the 'dead' stage. The salt has little, if any, effect on the ore in the running stage, but soon after this stage it melts, and, being a miscible liquid, thoroughly permeates the ore, penetrating by the heat fractures to the very centre of the particles. (This probably explains why coarse crushing can be adopted in this process). The ore is now at a good red heat, and most of the volatilization is taking place. If the fuel-gas be turned off for a few moments—whereby a good view of the furnace is obtained—it will be seen that large volumes of gas are escaping from the ore, which burn with the characteristic blue flame of arsenic. Under these conditions dense white fumes can also be seen slowly floating to the back of the furnace. As the ore approaches the hottest part volatilization is still proceeding—10 to 15% of the gold going off in this zone, but no fume is observed, unless an excess of salt has been used in the charge, in which case the fume of sodium chloride will be given off even when the ore is discharged from the furnace.

The correct temperature is clearly indicated, and with gas-firing is easily controlled. Should the temperature get too low, the fume of arsenic comes off in great volume from the ore as it discharges; if too high, the ore commences to frit badly, to the extent even of forming great half-molten 'blooms.' With a

temperature a little higher than that actually required the ore frits slightly and has the appearance of coarse bread crumbs—what the workmen call “little crummy clinkers.” I found that the furnace-men preferred to discharge their ore in this form, as they were then sure that the temperature was not too low, nor is there any objection to this slight fritting, so long as it only takes place at the very end of the furnace. As soon as the ore fuses on the edges volatilization of the gold ceases, and if this fritting is noticed six feet or so in the furnace it means that so much of the length of the furnace is wasted, and that 2 to 5% of the gold will be retained in the residue. Since the furnace-man is never long away from the valve controlling the gas-firing, a wrong temperature is quickly righted, and the harm done is not of great importance.

The mixture of ore and salt, when heated in the furnace, produces a dense white fume, which by the draught is drawn into the dust-chamber. Here most of the dust settles, and about 15% of the fume condenses. The remainder of the fume with a little fine dust passes on, and is drawn through water several times, as already described. In this repeated bubbling the gases are broken-up into an extremely fine state so as to be absorbed by the water.

This absorption-water after a time becomes dark green in colour, from the presence of ferrous chloride in solution, and if examined in a beaker a number of fine particles will be seen in suspension. These consist of particles of dust from the ore, and metallic gold (black). It is probable that a few particles of gold, brown in colour, will be observed floating on



FIRST EXPERIMENTAL PLANT AT GWALIA CONSOLIDATED.

This is one of the advantages this process has over roasting before cyanidation. In the latter case if the roast goes wrong, particularly with complex ores, it may take the furnace-man one or two hours to get it right again, and in the interval it is probable that the badly roasted ore may ruin the whole charge of a cyanide vat. In the volatilization process if anything goes wrong, the residue is only affected for that particular time, and does not contaminate anything going before or coming behind them. Not only is gas-firing for this process advisable, from the point of view of being easily under control, but it is almost a necessity, since it produces no soot, and no dust from the wood ashes, both of which would be collected with the fume, and so contaminate the gold product when caught.

The temperature necessary for complete volatilization is orange to yellow heat—say 1000° C. This is easily maintained if the gases are fed to the burner at the temperature they leave the gas-generator, and if the air mixed with these gases before burning is pre-heated in a coil in the fire-box. In my experience the tendency for the men is to get too high a temperature.

the top of the water. This water is pumped through a filter-press, where the fine dust and gold are retained, while the clear filtrate is returned to the bubbling-chambers again.

Chemically considered, this water is found to become strongly acid by reason of hydrochloric acid and a little sulphurous acid. Antimony and arsenic (as lower oxides) are present in solution as well as calcium and sodium. When the furnace is working well the whole of the chlorine in the 5% of salt is driven from the ore, and appears again as chlorides in the absorption-water. In the experiments on the Gwalia ores, one-half to two-thirds of this chlorine came over as hydrochloric acid. This large production of acid was not recognized in the early experiments, and as we had no carpenter on the mine we determined to use an ordinary iron vat as the first absorption-chamber, believing it would stand for some considerable time. Luckily this vat stood the corrosive action of the acid until the last three hours of the test, when the first two partitions gave way. This threw half our absorption area out of gear, and caused a loss of gold at the very end of the run. After this accident we determined the amount of acid produced

in the furnace, and found further that only wood, earthenware, or lead could be used about the collection plant with safety. After two months' run these materials were quite unaffected.

In this short article it is not my intention to go deeply into the chemistry of the process, nor, as a matter of fact, am I able to do so. The reactions taking place in the furnace are undoubtedly complex, and at this high temperature not easy to determine. We were naturally not equipped with an elaborate chemical laboratory on the mine, and, therefore, little could be done. From observation of the working and from one or two qualitative experiments it is evident that arsenic is driven off as arsenious oxide, and as an arsenite of either calcium or sodium. In the dust-chamber a good deal of yellow sublimate is noticed (arsenic sulphide?). Curiously, although there is excess of air, iron and copper chlorides come off in the "ous" state. Calcium and sodium chlorides are also driven off. Hydrochloric acid is given off in large quantities, and this gas with water-vapour causes a dense fog, even after the arsenic has been condensed. This thick fume no doubt holds up a good deal of the gold in the form of fine particles, which are most difficult to arrest and absorb.

Most of the gold appears to enter the absorption chamber in the metallic state. Some of it may be volatilized from the ore as a chloride, which immediately dissociates, while another source would be from the arsenates or pyro-arsenates formed during roasting, which are split-up by the salt at the high temperature, metallic arsenic being liberated. This arsenic immediately unites with the gold to form arsenide of gold, which is volatile and burns in contact with air. This seems probable since precipitated gold heated with salt and calcium pyro-arsenate to a high temperature can be readily volatilized in the laboratory. A smaller percentage of the gold leaves the furnace in combination, perhaps as the chloride, but more probably as the double chloride of hydrochloric acid or even sodium chloride. However, it is found in practice that in whatever form the gold may exist, it can be completely taken out of the fume if the latter is finely broken-up in water, and in such a strongly reducing solution (consisting most of ferrous chloride) it is not surprising to find that it is all in the metallic condition, and that not a trace can ever be detected in solutions.

As this absorption of the fume has been the

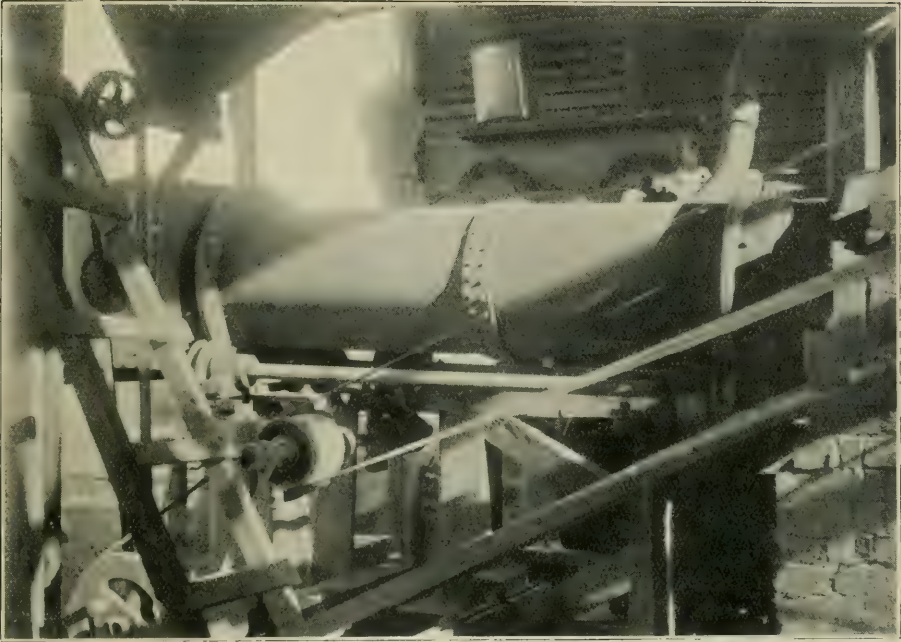
stumbling-block of the process up to the present, it would be well to consider it a little more closely. According to H. C. Parmelee (see *Metallurgical & Chemical Engineering*, Vol. XI, page 230), Messrs. Pohlé & Croasdale when experimenting with this process in 1898 found great difficulty in their condensation, and the problem was never satisfactorily solved by them. They tried collecting the fumes in 'bag-rooms': so did we, but gave this up owing to the large amount of sublimate produced (70 lb. per ton of ore), and to the corrosive action of such large quantities of hydrochloric acid on the bags. They (and we) next tried scrubbers, which were unsuccessful owing to the large size required for effective absorption, and the difficulty of cleaning-up gold slime in such a large area. Further atomizer sprays were a failure, in the first place, as they are not effective on the acid fog; and, secondly, with us, as we were unable locally to make a large lead pump (and a large one is required for the quantity of water to be handled) to stand a pressure of 40 lb. per square inch, the pressure necessary for these sprays.

The secret of successful absorption seems to be to break the gases up into fine particles in water, and to use the same water over again. Owing to the prominence given to the failures of Mr. Croasdale in America, and of the Gwalia plant in Australia, many engineers have doubted whether the fume absorption will ever be successful. I can assure them that it already has been successfully accomplished in my first plant, but on this point I can give testimony other than my own.

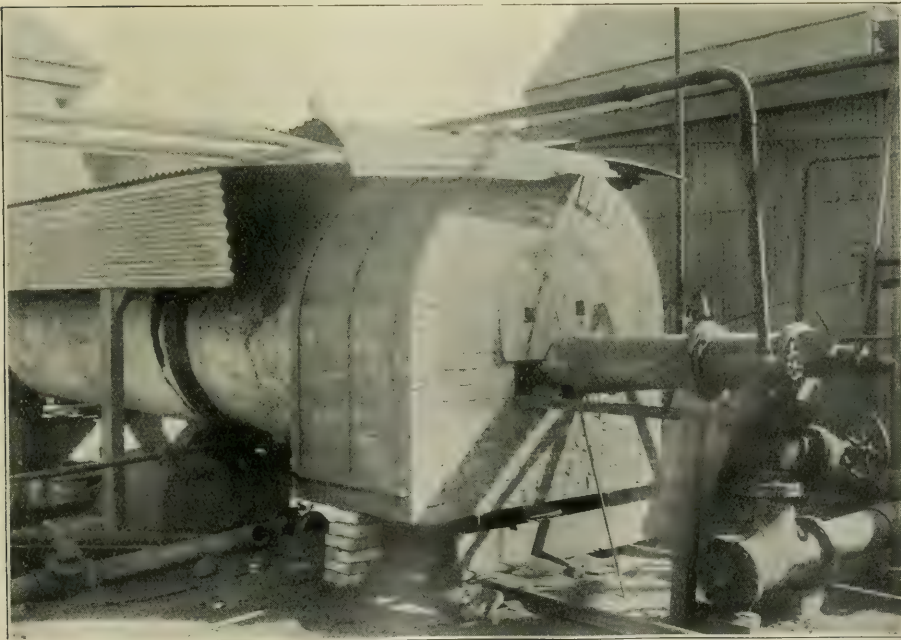
Let me quote the opinion of the well-known metallurgists who watched, officially, the test on our first furnace. During this run 92% of the gold was volatilized from the ore, and 85.7% actually recovered from the absorption plant. All parties concerned subscribed to these figures. Further, Bewick, Moreing & Co's. representatives in their report said:

"The whole of this plant worked quite continuously and most satisfactorily until the latter part of the last day, when the partitions (iron) in the tank collapsed and rendered the conditions generally prejudicial to the best results. It is remarkable in such a small test that so large an amount of the gold was accounted for. A similar result could not have been got in a cyaniding or amalgamation test on a like tonnage.

"It would thus appear that the method is one offering considerable elasticity of conditions, and from my own observations of the



SMALL FURNACE, SHOWING SQUARE DUST-BOX, WITH FEED-HOPPER ABOVE.



LARGE FURNACE, SHOWING FIRE-BOX AND GAS-BURNER.

conditions generally I draw the following conclusions:

"(1). That the preliminary roast necessary to drive off such volatile constituents as might subsequently interfere with the gold volatilization and collection should require a reasonably low temperature. (This refers to the idea that a preliminary roast may be necessary before volatilization).

"(2). That the volatilization itself can also be effected at a reasonably low temperature and under such conditions as could be readily obtained in practice.

"(3). That the collection of the gold can be readily effected and on the large scale should yield a very clean bullion."

Hooper & Speak's representative in his report said:

"For an experimental plant the run was particularly good. It is rare in work of this character to record the absence of stoppages.

"After the breakdown of the iron tank at the end of the run, to locate 85.5% of the actual gold contents in such circumstances was very creditable.

"No possible doubt can exist with regard to the volatilization efficiency.

"Commercially the process predicts a 92% extraction, cheaper working costs per ton than any other process yet evolved (for this ore), and less expense for plant equipment."

It will no doubt be urged against me, and with reason, that if this smaller plant was so successful why was I not equally successful with the large plant? This is why: the vacuum of two inches of mercury, for a large volume of air, takes more power than I wished to use, and I thought I could absorb the fume more easily with atomizer sprays, and with one-twelfth the vacuum. I had not then heard of Mr. Croasdale's work and his want of success with sprays. I put sprays in, they were not successful, and we never had either the time or the money to go back to what we knew would be successful.

Yet the erection and working of the big plant was by no means the absolute failure it appeared to be. We found one or two accessories in the plant that worked well, and noted others to be avoided. Our furnace was 5 ft. diam. by 27 ft. long. It should have been 45 or 50 ft. for this diameter. Our furnace was red hot even at the cool end, so that the heat losses were excessive. The greater length would not only have conserved the heat better, but by giving a greater length in which to roast the ore would have increased the capacity of the furnace. In the 27 ft. furnace the

first 12 ft. were taken up by the ore roasting, leaving only 15 ft. for the volatilization. This meant that we had to run with too thin a layer of ore. For the number of times that a given amount of ore is turned and exposed in 15 ft., twice the amount of ore would be exposed equally often in 30 ft. The brick lining to this furnace was only 4 inches thick (all we could obtain at the time) when it should have been 9 in. thick. The thin lining meant an enormous loss of heat, so great indeed that our fuel consumption, using wood in the generator, worked out at about 50% of the weight of the ore. To show that this high fuel-consumption was alone due to the bad design of the furnace, I roasted a quantity of ore in the same furnace and found the fuel-consumption to be exactly the same. Now, having previously roasted this ore for some months in a simplex Edwards furnace for much less than half this consumption, I was able to say that the ore was not calling for this heat, but that it was the furnace that was dissipating it. With a good furnace I should say that the fuel consumption, using wood, would be about 16% of the ore treated. We found with this big furnace that a slope of 1 in. per 6 ft., and a speed of 1 rev. per min. were about right.

Our gas-burner was simply a 10 in. pipe passing from the producer through the fire-box, and cut-off flush with the mouth of the furnace. A 2-in. pipe delivering pre-heated air was screwed into a blank flange at the back of this pipe, so that hot air and gas were mixed in the last six feet of the pipe before burning at the nozzle. Both air and gas were at a temperature of 400° to 500° C., and under these conditions we had no trouble in keeping the furnace temperature between 1000° to 1200° C. The amount of air per minute passing through this furnace when treating 20 tons per day was 1200 cubic feet.

At the cool end of the furnace the opening was contracted to 2 ft. diam., and this opened direct to a dust-box made of thin iron plates. The dimensions of this dust-box were 8 ft. long, 8 ft. high, and 2 ft. wide. It is not advisable to have this dust-box too large, as an excess of sublimate may condense in it; moreover an important point to remember is that baffles are more effective than large spaces for arresting dust. In this dust-box we had an excellent baffle, which as far as I know is new.

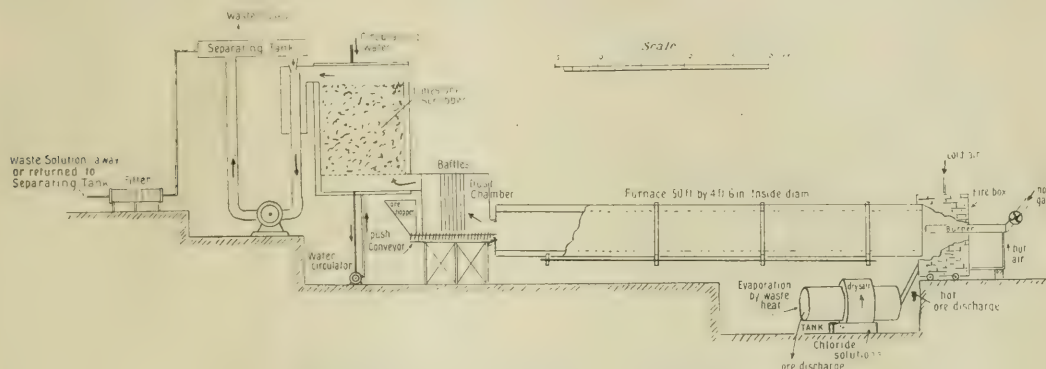
A number of $\frac{1}{2}$ in. holes were punched in the top of the dust-box at $\frac{3}{4}$ in. pitch, and arranged in a zig-zag pattern as shown in the sketch, which is a plan of the top of the box.

A 7 ft. long, $\frac{1}{2}$ in. rod, burred up at one end was dropped into each of these holes, so that it hung vertically from its burred end into the inside of the dust-chamber. These rods hanging so close together made practically a continuous zig-zag baffle. The furnace gases had to traverse between these baffles, and would take the direction shown by the arrows, striking first against one wall and then against another. The inertia of the dust particles would cause them to strike the rods, and in so doing they

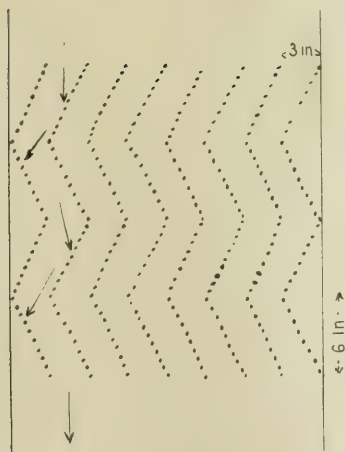
knock against each other, which clears them immediately.

A push-conveyor working in the bottom of the dust-chamber will feed ore into the furnace and at the same time automatically return any dust that settles in the chamber. Do not use a screw-conveyor. They are not to be compared with push-conveyors for dry ore, particularly if there is any heat about.

In passing through this dust-chamber the furnace gases are cooled considerably, and



FULL-SIZE PLANT AT GWALIA CONSOLIDATED.



Plan of Dust-Box.

would lose their velocity and could, therefore, no longer remain suspended in the air, but would fall to the bottom of the chamber. The sublimate that condenses on these rods sticks well to them, so that it would in time close the passages, and that is why the baffles are made of hanging rods and not fixed plates, which would be difficult to keep clear. To clear the rods, all a workman has to do, once every four hours or so, is to give the rods a shake with a piece of wood. Being free to move they commence to swing about and

80% of their dust should be retained here. It is highly important to settle as much of the dust as possible, without condensing too much sublimate.

The fume leaving the dust-chamber is made to enter a medium-sized scrubber, which should be built of wood. For a furnace treating 30 tons per day this scrubber should be about 10 ft. diam. by 12 or 15 ft. high. Water should be constantly circulated in this from the top to the bottom, and the packing should be limestone about four inches in diameter. Here the fine dust will be arrested and most of the hydrochloric acid absorbed by the lime. Anything up to 25% of the gold should come down here, and after the plant has got into its stride, this gold with the fine dust should form a product valued at 100 oz. gold per ton. This product may be settled out and cyanided, while it will be found necessary to cool the solutions before returning. In passing, I should mention that the volatilized gold is extraordinarily amenable to cyanide treatment. Even the richest products after a few hours contact with strong cyanide solutions (0.25% or over) are completely denuded of their gold.

On leaving the scrubber the gases are quite cool and practically free from dust. It now only remains to break them up very finely in water before discharging them into the atmosphere. There are two methods I should re-

commend for doing this: (1) pull them by means of a Root's blower, through water, causing them to bubble several times before they finally reach the blower, or (2) pass them direct into an apparatus that beats and churns the gases thoroughly with water. In either case it must not be forgotten that wood, earthenware, or lead (regulus metal, 17% antimony and 83% lead, is good) are the only materials that can be used.

A special form of apparatus for mixing the gases in a very fine state of division with large volumes of water has been designed by me. This apparatus consists essentially of two legs of an inverted syphon about 12 and 15 ft. long respectively. In the bend of the syphon a centrifugal pump of special construction is arranged to work at a high speed, causing the circulating solutions to be drawn down the short leg and forced up the long. Since the system is almost balanced, little power is required to work this pump. The short leg at its top end is furnished with a large number of holes drilled downward, and as the water travels down the leg toward the pump it sucks the fume through these holes on the principle of a 'trompter,' or of the hydraulic air-compressor. Even in this leg the bubbles of gas are broken up in the water to some degree of fineness, but when the mixture passes into the rapidly revolving pump the gases are emulsified in the liquid and pass up the long leg in this fine condition. They are in contact with the reducing solutions for the appreciable time necessary to reduce any gold compounds present in the gases. At the top of this long leg is placed a large tray in which the liquid settles for a time and allows unabsorbed gases to escape before the liquid, freed from gases, descends into the short leg again to engage more fume. A measured quantity of this circulating water is taken off to a filter, either a gravity filter, such as is used for clarifying cyanide solutions, but made of wood with a lead pipe, or a lead-lined filter-press. A combination of these filters is very useful, a solution thick with gold slime being obtained in the gravity filter, which may then be pumped through the filter-press in a few minutes. While the material in the gravity filter is accumulating a fresh charge, wash-water may be passed through the press to remove any corrosive solutions, and in this way an iron press may be used. With the gold in the filter-press the process becomes theft-proof and fire-proof, and an almost complete cleanup may be made at any time.

Before I left the Gwalia Consolidated I

offered to exhibit this apparatus under test, but I insisted on a third man being present to watch the test. Unfortunately, the directors could not agree to this, and so I have no tested figures to give of its working.

Such, then, is a brief description of my volatilization process and experiments. The excellent results obtained with refractory ores, particularly those carrying arsenic, antimony, and copper, have led me to believe that it is a process that will soon find an application on those peculiar refractory ores that cyanide will not touch or at best only show a very poor extraction. So far nearly all ores tried have been found amenable to the process, though with copper ores the salt has to be increased, but against this the copper contents are recovered quite apart from the gold. With ores containing over 10% antimony, the roast has to be more carefully and slowly conducted. It would appear to be cheap to work compared with roasting and cyaniding, is simple, and requires much less capital expenditure than a big cyanide plant. Where salt is cheap 5% is not a prohibitive amount, and where the price is a consideration, the chloride solutions leaving the limestone tower, after filtering, can be easily evaporated down by the waste heat given off from the hot ore as it is discharged from the furnace. This evaporated salt, consisting mostly of calcium chloride, mixed with 1 to 2% sodium chloride, will act as well as the 5% common salt alone. A 200 oz. gold product was obtained in Australia in the filter-press from a 10 dwt. ore. If this product is not rich enough to smelt outright it can be concentrated further by means of cyanide or chlorine.

To state that much remains to be done before the process is perfect is a banality, but I contend that sufficient has already been achieved to demonstrate that the process promises to solve the problem of the extraction of gold from cupriferous and antimonial ores that have hitherto resisted successful treatment.

The Annual Report of the Geological Survey of South Africa for the year 1912 contains the paper by E. T. Mellor on the 'Geology of the Western Witwatersrand.' Another paper of interest is by A. L. Hall on the 'Geology of the Country between Middelburg and Belfast,' a district where the coal measures are being developed. W. A. Humphrey describes the part of northern Natal between Vryheid and the Pongola river, where the Wonder and other gold mines are situated.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

The Future of the Rand.

The Editor:

Sir—In your November issue there is a letter from Mr. Ralph Stokes pointing out that Mr. Troye “without all available knowledge of the facts” was handicapped in his attempt to value Rand mining shares. With this axiom most of us will agree. The question arises, however, why shareholders should not be informed of “all the available facts.” If all mines made a point of publishing to their shareholders full yearly plans, sections, and cross-sections of the mine, and also a monthly report from the mine manager giving results of current development in detail, naming every working face, a great many irresponsible rumours would be knocked on the head, and with the facts before him a shareholder could form his own views, and, if he took the trouble, could keep an assay-plan of the mine up to date.

This is possible, for instance, for those interested in the Golden Horse-Shoe and some other Australian mines. But the average mining report, especially from the Rand, gives only the results of development in bulk: So many tons of ore ‘payable’ value to two places of decimals; so many tons of ore ‘unpayable’ value to two places of decimals, and a bare summary of development footages with average assay-values. Certainly, to make up for this the average value is worked out to 0’00 of a dwt.!!!

The Rand has, I believe, nothing to fear from giving shareholders and the public generally full information as to all “available facts.” The majority of the mines would probably appreciate in public favour if full information were given, and those mines that refused to follow suit could be conveniently left alone by the public.

The only reasons I have heard against publishing full plans and monthly reports are:

- (1) The expense.
- (2) Shareholders would not understand them and don’t want them.

With regard to the first objection, the cost of publishing the Golden Horse-Shoe plans is under £100.

The second objection carries no weight, as although some shareholders would not take

the trouble to study the reports and plans of their property, there must be many who would gladly do so.

E. HOMERSHAM.

London, November 3.

[We have seen the Golden Horse-Shoe plans and sections, and endorse Mr. Homersham’s compliment to Mr. J. W. Sutherland, the manager of that mine. They give the explicit information that is required to tell the results of development.—EDITOR].

The Editor:

Sir—Messrs. G. W. Troye and Ralph Stokes, discussing the future of the Rand, have raised as an incidental issue the larger question of the future of the mining industry of South Africa. Mr. Troye goes so far as to suggest that the nickel deposits of East Griqualand show promise of becoming as important as the Sudbury deposits of Canada and may in the future be one of the mainstays of South African mining.

Mr. Stokes asks Mr. Troye for an amplification of the comparison between the Insizwa deposits and those at Sudbury “so that Canada may look to her laurels.” As I have recently made a geological examination of the Insizwa range with a comparison as one of the particular objects in view, the following brief remarks may be of interest to readers of your Magazine.

Many of the principal features of the structural geology of the two districts closely resemble one another. The ore deposits in both cases are derived from exceptionally large masses of gabbroid rock that have undergone gravitative magmatic differentiation. The shapes of the two gabbroid masses are somewhat similar, both being more or less basin-shaped, although the formations, into which the two intrusions have been respectively injected, differ widely. A comparison between the various nickel deposits of the world discloses the fact that this metal is commonly associated with rocks of a gabbroid character or their altered derivatives and that, broadly speaking, the greater the mass of basic rock the more extensive are the ore deposits. Comparing, then, the relative sizes of the two occurrences under review, the dimensions of

the Sudbury eruptive are approximately as follows: length, 36 miles; breadth, 16 miles; thickness, 10,000 ft. The dimensions of the Insizwa sheet may be put down approximately, for the main basin connects with some large but irregular arms, as having a length of 20 miles; breadth, 10 miles; thickness, 3000 feet. The volume and mass relation of the Sudbury sheet to the Insizwa, as the two masses exist today after indeterminate quantities of the original magmas have been removed by denudation, may then be roughly stated as about 10: 1. Although the Insizwa sheet appears to be very much larger than some of the intrusives in other parts of the world that have produced workable nickel deposits, it is obviously much smaller than the Sudbury mass, so that on these grounds Insizwa can scarcely be expected to dethrone Canada from her proud position as the world's greatest nickel-producer, while on the other hand the Insizwa range offers mining prospects of no common order of magnitude.

The Sudbury sheet as a whole is rather more acid in composition than the Insizwa and the greater basicity of the latter might be considered as favouring a higher initial mineralization. It is worthy of note in this connection that the general facies of the rocks into which the Sudbury sheet has been injected, appears to be more acid than that of the Insizwa series. The Insizwa sheet, too, seems to me to have been injected into its encasing sedimentary rocks before these were consolidated and while they were in a moist plastic state, possibly under the ocean. I draw attention to these points as it is possible that the Sudbury magma assimilated a relatively greater quantity of acid rock by the process of magmatic stoping, thereby increasing both its acidity and volume to a relatively greater extent. Both sheets show progressive increase of basicity proceeding from the upper to the lower margins, but whereas at Sudbury the most basic phase is composed of solid sulphides of iron, nickel, and copper, the marginal ore deposits, at Insizwa the purely magmatic differentiation—so far as it has been disclosed to date by prospecting operations—stops short at the pyrrhotite-norite phase, the solid sulphide deposits at Insizwa, underlying this phase, owing their concentration to a rearrangement of a secondary character. Exploratory work along the Insizwa range has not been carried sufficiently far to prove whether this pyrrhotite-norite is the fringe of a more compact segregation of sulphides farther down the basal margin, where this

margin may have had the advantage of the settlement from a greater thickness of superincumbent rock.

Space will not permit a full discussion of the geological evidence on this point, but I may mention that the results of my sampling of the principal workings in the range showed that there was a marked increase in the valuable constituents of the pyrrhotite-norite with increase in depth, and they suggest strongly that exploration at lower levels may disclose high-grade pyrrhotite-norite and possibly solid sulphide orebodies of the Sudbury marginal type. High-grade solid sulphide orebodies have been found at the base of the Insizwa eruptive and it was the weathered products of these that first attracted attention. These segregations are undoubtedly derived from the overlying pyrrhotite-norite zone. The rock upon which the Insizwa eruptive rests is a fine-grained hornfels. Cutting across the hornfels-norite contact zone there are a series of irregular fissures evidently generated as a result of stresses set up by changes in volume arising from the cooling and simultaneous crystallization of two entirely different rocks in juxtaposition. The sulphides, which were the last minerals to solidify, have been to some extent squeezed out of the pyrrhotite-norite zone into these fissures. Unfortunately exploratory activity has so far been largely confined to 'chasing' the rich ore found in these comparatively small erratic strain-cracks, which are nothing more than 'droppers,' in the hope that they would 'make' into extensive high-grade orebodies, their geological relationships not having been sufficiently appreciated by the 'practical' miners by whom the very indifferent prospecting of the range has been done hitherto. It must be admitted, however, that the grade of ore discovered in these fissures was astonishingly high and, with the attractive platinum contents not infrequently shown by assay, it is not altogether a source of wonder that the small funds of the local syndicates and companies financing prospecting operations, were soon dissipated without developing any large orebodies.

The high grade of the ores in these fissures suggests that, if solid sulphide marginal deposits have been segregated under the thicker parts of the eruptive, they may prove to be richer than the corresponding deposits at Sudbury. The ratio of platinum to the base metals, both in the fissures and in the pyrrhotite-norite, also appears to be much greater than the average for Sudbury, though the Sud-

bury statistics are somewhat meagre on this point, and, of course, the small amount of useful work done at Insizwa makes it undesirable to generalize on such points.

No large gossan formations, comparable with those found capping the marginal sulphide deposits at Sudbury, have hitherto been found at Insizwa, nor are there any surface indications of deposits closely comparable with the Sudbury offsets, though there are some dikes cutting the eruptive and carrying sulphide ores associated with a gangue that appears to be a kind of aquo-igneous re-melt of rock from the neighbourhood of the norite-hornfels contact. It would be a mistake however to conclude from this negative evidence that there are little or no prospects of the discovery of solid sulphide marginal deposits at Insizwa. The conditions of denudation have been quite different over the two areas. It is not improbable that denudation, though profound even at Insizwa, has not proceeded so far as at Sudbury and that only a tapered comparatively acid fringe, with relatively subordinate development of the basic phases, has been cut away by weathering. Geological evidence is not wanting at Insizwa that the outer edges of the sheet were composed almost entirely of the more acid type of rock, which is what would be expected on theoretical grounds in the case of a basin-shaped mass of magma differentiating into fluid phases of varying specific gravity. It is commonly believed that millions of tons of marginal sulphide have been completely denuded away at Sudbury, though it is admitted that no trace of the enormous quantities of copper and nickel so denuded has been found in deposits of secondary origin. I venture to suggest that it is probable that the ultra-basic phase never did extend to the extreme upturned edges of the Sudbury sheet, and the absence of a large secondary deposition may be due in part to absence of the marginal deposits from much of the outer denuded portions. An interesting point in connection with the chemical geology of the sulphides is that their order of separation in the pyrrhotite-norite at Insizwa is exactly the reverse of that at Sudbury, clearly indicating that the physico-chemical equilibrium conditions during the freezing of the mineralized zones were different in the two occurrences.

I have endeavoured to compare the two occurrences in as brief a manner as possible, the one highly developed and concerning which there is an abundance of reliable information based on many years of mining experi-

ence and close geological study, the other undeveloped and on which just sufficient work has been done to show its geological structure. Summarizing, it may be stated that the Insizwa range today, with its thirty miles of marginal outcrop, is practically a virgin prospect of an exceptional order of magnitude, with speculative possibilities, not of out-rivaling Canada as a nickel-producer, but of becoming a large producer of platinum in conjunction with nickel and copper. In addition, it may become one of the most important factors, outside of the Rand, in the future of the mining industry of South Africa.

W. H. GOODCHILD.

London, November 28.

Ore.

The Editor :

Sir—Although I have great respect for my friend E. T. McCarthy's authority as a mining engineer, I must demur to his new definition of the word 'ore.' I cannot conceive that coal, mineral phosphate, or limestone will ever be dubbed 'ore,' even by the indiscriminating public, although in the eye of the law, which in these matters is guided by the Railways Clauses Consolidation Act of 1845, these substances, and even slate and some varieties of clay, are regarded as 'minerals.'

The word 'ore' is so well established in its uses to embrace such of the heavy metals or their compounds as are the object of exploitation in mines, that I do not believe it will be possible for Mr. McCarthy, even with the powerful aid of *The Mining Magazine*, to effect the change in its meaning he desires.

F. H. HATCH.

London, November 22.

The Editor :

Sir—In response to your invitation, I beg to submit the following definition of 'ore':

Any natural substance mined for the purpose of commercially utilizing in the arts (except stone used for statuary, building, or ballasting), manufactures, or agriculture, any or every element or compound which it may contain.

It seems unnecessary to add the phrase "with or without preliminary treatment or reduction," as also to add "from the earth" after mining. The above definition includes every possible method of mining even to pumping, every kind of mine from the iron mine of the savage to a deep level proposition on the Rand, and every mineral, including gems, coal, oil, phosphates, etc.

To speak of 'payable ore' then becomes only less stupid than to speak of 'unpayable ore.' You may have a handful or a million tons of ore, but you may not have a handful of 'unpayable ore' any more than you may have a bucketful of hot ice.

There is nothing in the definition which precludes the dump or the gob being mined later for ore, but there is no loophole which allows of unpayable mineral being called "unpayable ore," for until such time as mineral is "mined for the purpose of commercially utilizing, etc.," it is not ore. It may be called 'waste,' 'rock,' or 'mineral,' but it must not be called ore. What is and has been miscalled "unpayable ore" is nothing more or less than rock containing a percentage of some one or more minerals which may be elements or compounds, simple or complex.

As it may be deemed unwise to include, as ores, organic substances, such as oil, amber, coal, bitumen, etc., the definition may be amended by inserting the word 'metalliferous' before 'substance.' In this way we open the way for the possible ultimate inclusion of any mineral containing Ba, Sr, Ca, Mg, Al, Mn, Ti, Cr; we also include arsenopyrite by reason of its iron, as also fluorspar, tincal, and phosphates by reason of their respective calcium and sodium, but we exclude realgar and orpiment, also rock crystal and sulphur.

This leaves us with the final alternative of inserting instead of 'metalliferous' the word 'inorganic,' using the word in its chemical sense, 'organic' in chemistry meaning carbon and its compounds. In this way we include every known mineral except coal, diamonds, graphite, oils, bitumen, and such like substances.

Whether it would be necessary to add also "and carbonates," making the definition read "Any natural inorganic substance or carbonate," etc., I cannot say.

STEPHEN J. LETT.

London, November 19.

The Editor:

Sir—In response to your invitation, I venture to add my opinion on the subject of Mr. McCarthy's excellent contribution.

So far we have had three distinct divisions in mining, namely, coal, ore, and stone mining.

Coal stands by itself, requires no further definition, and it seems to me unnecessary to drag it in under 'ore,' even if it partly conforms to the definition of that material. The want of a clear definition of the term 'ore' has long been felt, and our thanks are due to

Mr. McCarthy for giving us the first lucid unambiguous proposal in this direction. I should like, however, to suggest a simplification, using Mr. McCarthy's definition as a basis, as follows:

An ore is any natural product, derived from the earth, which *contains* either an element, a chemical compound or a mixture of compounds, that requires *extraction*, either mechanical or chemical, for the world's use in the arts, manufacture, or agriculture.

The sense of this is practically the same as Mr. McCarthy's, with which I am quite in agreement, and I only suggest it as shorter and more simple. Whether there is a profit or a loss made in the operation of mining does not affect the definition at all, which I think is a point in its favour.

I should however still retain the three main headings:

1. Coal.

2. Ore, as defined above.

3. Stone. All material mined that is not subject to treatment for the extraction of any particular valuable constituent.

W. F. A. THOMAE.

London, November 29.

The Editor:

Sir—I submit the following definition of 'Ore':

A mineral or aggregate of minerals containing one or more elements of commercial value.

If anybody asks "When is an ore not an ore?" the answer is obvious, for we all know of minerals once extracted at a loss that today have a commercial value, that is, are saleable. An ore may be extracted at a loss to the producer, but to the gain of the purchaser, and undoubtedly to the gain of the community.

G. PERCY ASHMORE.

London, November 29.

The Editor:

Sir—No definition of 'ore' can be made which will be free from criticism, mining being an art rather than an exact science. Unprofitable material today becomes profitable tomorrow, and the profitable of one time becomes profitless thereafter, such as the quartz stringers in French Guinea formerly worked by slaves at practically no cost to the proprietor.

The essential point is to bring about the universal use of the term in the same sense as nearly as possible. Mr. McCarthy's definition is so broad as to lack definition, whereas if Mr. T. A. Rickard's is used (metal-bearing

rock that, at a given time and place, can be exploited profitably) a statement must be added as to the limit between 'profitable' and 'unprofitable' material (waste). This to me seems an advantage rather than a disadvantage, as it brings forward at once a distinction too often not clearly made, if at all. To my mind, there is less confusion in confining the definition to profitable metallic substances, not including the non-metallic minerals, such as coal, but rather speaking of them as such. 'Positive,' 'probable,' and 'possible,' if the exact meaning is known, are useful adjectives, but I prefer, as conferring more nearly the desired idea, 'developed,' 'partly developed,' and 'probable.' There is no way however of getting around the necessity of stating just what the size of the blocks are and the distance assumed beyond workings; which brings forward the question: Why attempt a universal definition if it is necessary to add so much to make it fit the particular case?

HOWARD D. SMITH.

London, December 1.

The Editor:

Sir—Referring to your request that I should contribute to the discussion of this subject, I do not know that any opinion I can express will be of much interest. I am partly, but not entirely, in accord with the views of Mr. E. T. McCarthy, published in your last November issue.

For instance, I do not see that any particularly useful service would be served by including coal, baryta, phosphate, etc., under the designation of 'Ore.' Commercially useful non-metallic products, such as these, are, it seems to me, equally well, if not better described as 'minerals.'

Even accepting Mr. McCarthy's contention, that logically all should be included under the term 'ore,' it strikes me that the definition he suggests would, in certain cases, still leave the difficulty unsolved. Take, for example, valuable specimens of native metals, gold, silver, copper, etc., which are not changed chemically or physically, and which do not necessarily have any substance deleterious to their usefulness removed. Can they be logically excluded from ore?

Then, take such substances as sulphur and petroleum. What is their position? The position of petroleum being peculiarly trying and complex, for it may be animal, vegetable, or mineral in its origin, as different people believe.

I will not myself attempt a comprehensive

definition of 'ore,' but I have a pretty clear idea in my own mind of what the term 'ore' conveys; sufficiently simple and comprehensive to cover my own requirements. And it is necessary, I think, in this connection, to draw a line of distinction between 'specimen ore' and 'ore *in situ*,' or offered for sale in bulk. By 'specimen ore' I mean ore placed in museums or sold as such to dealers; to which Mr. McCarthy's definition scarcely seems to apply. 'Ore' of this class I regard as being a metal, mineral, or aggregation of both, from which any metal of commercial value can be or might be extracted at a profit.

Broadly speaking, it seems to me that the same description is applicable to 'ore *in situ*,' so far as relates to its composition, but when speaking of 'ore' in a commercial way, quantity, mode of occurrence, situation, working facilities, markets, and other factors have to be taken into account, and it is obviously necessary to adopt more accurate phraseology, and to state whether it is payable or unpayable, positive, probable, or possible. Consequently a composite definition of this kind must in my opinion be employed in order to correctly describe 'Ore *in situ*.'

In this respect I go a step farther than Mr. McCarthy, who says it is "useful" to do so. I maintain that it is *essential* to an understanding of what is meant by 'ore' in place. The case of ore in transit, in bulk, is simpler, because shipments of unprofitable 'ore' are but seldom made. I do not much like the expression "prospectively possible," but Mr. McCarthy's proposal of a fourth class of this kind to the three commonly recognized classes, seems to me to be sound.

A. G. CHARLETON.

London, December 1.

The Editor:

Sir—As a contribution to the discussion of 'What is Ore,' I give you the following extracts translated from 'Die Lagerstaetten der Nutzbaeren Mineralien und Gesteine' by Professors Beyschlag, Krusch, and Vogt:

"In relation to ore-deposits, any metalliferous mass from the like of which in the present state of the arts of mining, ore-dressing, and metallurgy, a metal or metal compound may in general be produced on a large scale and with profit, constitutes an 'ore.' The term in this sense does not, however, coincide with that of payability. It only demands that without considering the conditions of communication or the quantity present at any particular place

of discovery, such mineral matter in general is being applied under present conditions with profit and on a large scale to the production of metal. A mass of ore is, however, only payable when it occurs both in the necessary quantity and under those economic conditions which permit a profit."

With the ideas conveyed in this definition and description I am much in sympathy, though I might express them in the following terms:

"Ore is any metalliferous mass sought or mined in the material of the earth's crust."

In any particular case such metalliferous material is ore before its payability has been demonstrated; it is sufficient that the applicability of such material to the production of a metalliferous commodity should have been demonstrated in general.

Though you, Sir, have with much reason advocated the use of the expressions 'profitable' and 'profitability,' I have in this contribution used 'payable' and 'payability' because it appears to me that in reference to ore they are not only long-sanctioned, but apt. You may get your pay or your profit from an ore. Mining engineers and miners more often get their pay, and they have, therefore, found such terms as pay-shoot, pay-ore, pay-streak expressive and satisfactory. Though the word 'profit' might perhaps convey the same idea, it is by reason of an additional syllable, more clumsy in the formation of derivatives, such, for instance, as 'profitability,' and it is also a larger word in the sense that it is rather associated with the enterprise than with the ore.

S. J. TRUSCOTT.

[As the choice between 'payable' and 'profitable' is not a part of our joint effort to define ore, I deem it well not to delay an expression of regret that a gentleman engaged in teaching the principles of mining should advocate the use of bad English. The use of the intransitive verb 'pay' as if it were transitive, is bad enough, but the ignoring of its meaning in order to sanction a mere colloquialism is worse. Miners do not exploit ore deposits in order that they may be re-paid their expenditure or that the ore may be 'payable,' but to gain a 'profit,' which is more than 'pay.' The use of the word 'payable,' meaning, able to pay, ignores a basic principle of mining, which is not to meet the cost of operations, but to earn a surplus over yield.

When you pay a bill you pay the exact amount of it; payment involves the idea of balancing debit and credit; it does not involve an excess of credit. In any case, the terms blessed by Mr. Truscott are local: the use of

them is only sanctioned by Rand practice, which in such matters is more bucolic than academic. 'Payability' and 'profitability' are hideous concoctions, and wholly unnecessary. Apart from verbal nicety, the use of the terms 'payable ore' and 'unpayable ore' have been a source of confusion and mystification in the business of mining, for 'unpayable ore,' such as the 2 dwt. stuff appearing in the reserves of some South African companies, suggests something that is in the nature of an asset; when it is not. Thus a careless usage becomes a cause of bewilderment and affords a chance for chicanery. Mining is an art to which science is applied; among others the science of language.—EDITOR.]

The Editor:

Sir—As a definition of 'ore' I suggest:

A solid aggregate containing one or more metallic elements, at least one element being of commercial importance in quantity.

It seems impossible to frame a close definition. It is desirable to exclude traces, and small proportions, but with the latter concentration may bring confusion.

A. H. HEATH.

London, November 29.

Impoverishment with depth on the Rand.

The Editor:

Sir—The exhaustion of the oxidized free-milling ore, which occurred quite early in the history of gold mining on the Rand, left the mining engineers and metallurgists in that district face to face with the difficulties presented by the treatment of the low-grade and more refractory primary ore, a problem which was successfully solved by the introduction of the cyanide process. But with the advent of deep mining another and even more serious problem has presented itself. The gradual and uninterrupted falling off in the grade of the ore treated, as shown by the annual returns of the mining companies, has long been suspected to be due to an impoverishment with increasing depth, although the proof that this really was the cause could only be furnished by those who had access to the assay-plans of an important group of mines.* That proof has now been furnished by Mr. H. H. Webb, consulting engineer to the Consolidated Gold Fields of South Africa, who has stated in his official report that "the average

*In a lecture delivered to the Institution of Civil Engineers in 1911, I invited the big financial houses controlling the Witwatersrand mines to furnish the data necessary for the settlement of this question, so vital to the future of the industry. See Proc. Inst. C.E., Vol. CLXXXVI, Part IV, 1911.

value of the ore developed over large areas has been getting lower as greater depth is attained," and that this has been proved by careful sampling and assay of level by level, by stope-sampling, and by the yearly re-cast of ore reserves. The moral of this somewhat overdue admission is to be found in the invitation, extended in another portion of the report, to the Union Government, to lighten the burdens laid on the mining industry of the Rand, and so to assist in the reduction of working costs that must be effected in order to work at a profit the large areas of low-grade ore existing in the deeper levels.



YARETA.

I am also interested in another aspect of this question. Impoverishment in depth is a natural consequence of the infiltration theory of the origin of the gold (a view which since 1895 I have consistently advocated), because on this theory the precipitation of the gold is favoured by the diminution of temperature and pressure affecting the mineral-bearing solutions during their upward passage. It will be remembered that Professor Gregory, in his paper 'On the origin of the gold in the Rand Banket,' read before the Institution in 1908, used the supposed maintenance of grade as an argument to support his placer theory, which, unlike the infiltration theory, presupposes no impoverishment of the ore in depth.

F. H. HATCH.

London, December 5.

Copper and Bananas.

The Editor:

Sir—You are perhaps unfair to the managing director of the Fiji Copper Company; for there is a definite, but little known, connection between bananas and copper. Don't you remember that Sir Arthur Church, many years ago, isolated *turacin* from the quill feather of the Turaco, or plantain-eaters? Turacin contains about 7% Cu, and, as the banana is appropriately named *Musa sapientum*, there is a *prima facie* case for assuming that a banana expert might also possess almost Minerva-like wisdom about copper; so,

instead of returning the dollar to Mr. Cranston, you might have given a chance to some of your readers who are Fee-jeeologists!

T.H.H.

London, November 25.

Yareta.

In our issue of September 1912 a reference was made to *yareta* as a fuel used under boilers in Bolivia. This curious product of the high Andes is often called a fungus, which it is not. It is an umbelliferous plant, the *azorella glebaria*. By courtesy of Mr. C. L. Major, we give an excellent photograph of a good specimen, as seen growing at 15,700 feet

above sea-level. The range of distribution is from 13,000 to 16,000 ft. altitude. As a cheap fuel for raising steam, the yareta has economic value; it is bright green in colour and highly resinous; after being cut it is left to dry for several months before being carried to the mines on llamas or donkeys. The cost delivered is from 22 to 55 shillings per long ton. In the borax district of Cebolla on the main line of the Antofagasta-Bolivia railway an aerial tramway has been built for the transport of yareta.

Diaphragms made of spun glass are used in America for catching tarry vapours in producer gas. It is probable that similar material would find an application for the arrest and precipitation of fume in smelting works.

QUOTATIONS

of leading mining shares on the London Market
Shares are £1 par value except where otherwise noted.
Quotations are given in shillings.

	Dec. 1 1912	Nov. 1 1913	Dec. 1 1913
GOLD, SILVER, DIAMONDS.			
RAND :			
Bantjes.....	26	13	13
Brakpan.....	81	52	46
Central Mining (£12).....	200	165	147
Cinderella.....	21	5	3
City & Suburban (£4).....	47	46	48
Consolidated Gold Fields.....	66	45	40
Consolidated Langlaagte.....	30	27	30
Consolidated Main Reef.....	20	17	16
Crown Mines (10s.).....	141	125	122
Durban Roodepoort.....	20	16	17
D. Roodepoort Deep.....	22	20	17
East Rand Proprietary.....	67	42	39
Ferreira Deep.....	70	67	46
Geduld.....	23	20	21
Geldenhuis Deep.....	28	26	22
Heriot.....	81	60	60
Jupiter.....	13	3	3
Kleinfontein.....	26	22	22
Knight Central.....	12	6	7
Knight's Deep.....	45	26	27
Langlaagte Estate.....	27	18	20
Luipaard's Vlei.....	11	9	9
Main Reef West.....	20	8	7
Meyer & Charlton.....	100	97	102
Modderfontein B.....	68	77	78
Modderfontein, New (£4).....	250	225	225
Nourse.....	40	30	27
Primrose.....	41	28	30
Rand Mines (5s.).....	130	119	109
Randfontein Central.....	28	23	22
Robinson (£5).....	72	50	55
Robinson Deep.....	47	30	28
Rose Deep.....	60	46	45
Simmer & Jack.....	20	11	10
Simmer Deep.....	3	1	1
Springs.....	16	12	11
Van Ryn.....	76	66	65
Van Ryn Deep.....	19	35	34
Village Deep.....	43	36	35
Village Main Reef.....	50	36	36
Witwatersrand (Knight's).....	61	68	67
Witwatersrand Deep.....	53	57	55
Wolhuter.....	20	14	13
RHODESIA			
Cam & Motor.....	37	27	28
Chartered.....	27	21	19
Eldorado.....	33	13	14
Enterprise.....	19	11	12
Falcon.....	26	16	17
Giant.....	32	13	13
Globe & Phoenix (5s.).....	32	27	26
Loneley Reef.....	58	41	46
Shamva.....	66	36	38
Wanderer (5s.).....	2	1	1
Willoughby's (10s.).....	12	10	7
OTHERS IN SOUTH AFRICA			
De Beers (£2 10s.).....	122	370	351
Glynn's Lydenburg.....	25	15	13
Jagersfontein.....	105	102	102
Premier Diamond (2s. 6d.).....	47	205	195
Sheba (5s.).....	5	5	5
Transvaal Gold Mining Estates.....	51	51	48
WEST AFRICA :			
Abibontakoon (10s.).....	6	5	5
Abosso.....	20	13	15
Acham (4s.).....	21	16	17
Broomassie (10s.).....	5	6	5
Prestea Block A.....	18	10	13
Tanah.....	13	11	14
WEST AUSTRALIA :			
Associated Lead Mines.....	7	7	7
Associated Northern Blocks.....	5	11	13
Barrow Island (10s.).....	9	12	11
Barrow Island (10s.).....	43	51	51
Barrow Island Proprietary Co. Ltd.....	13	13	13
Barrow Island Proprietary Co. Ltd.....	2	2	1
Barrow Island Proprietary Co. Ltd.....	8	12	11
Barrow Island Proprietary Co. Ltd.....	71	56	56
Barrow Island Proprietary Co. Ltd.....	42	31	31
Barrow Island Proprietary Co. Ltd.....	22	21	21
Barrow Island Proprietary Co. Ltd.....	11	6	6

	Dec. 1 1912	Nov. 1 1913	Dec. 1 1913
OTHERS IN AUSTRALASIA			
Blackwater.....	23	19	19
Consolidated Gold Fields of N.Z.....	15	12	11
Mount Boppy.....	22	15	65
Mount Morgan.....	65	70	7
Progress.....	7	8	42
Talisman.....	37	42	1
Tasmania Gold (10s.).....	2	1	55
Waikiki.....	32	55	26
Waikiki Grand Junction.....	22	25	
AMERICA :			
Alaska Treadwell (£5).....	175	165	157
Buena Tierra.....	20	17	16
Butters Salvador.....	41	40	37
Camp Bird.....	23	14	14
El Oro.....	17	14	14
Esperanza.....	42	16	20
Granville.....	14	11	10
Mexico Mines of El Oro.....	147	107	102
Oroville Dredging.....	5	7	11
St. John del Rey.....	17	16	16
Santa Gertrudis.....	28	17	17
Stratton's Independence (2s. 6d.).....	2	1	1
Tomboy.....	28	26	27
RUSSIA :			
Lena Goldfields.....	65	42	40
Orsk Priority.....	20	6	6
Siberian Proprietary.....	13	2	2
INDIA :			
Champion Reef (2s. 6d.).....	12	10	10
Mysore (10s.).....	112	102	97
Nundydroog (10s.).....	32	26	26
Ooregum (10s.).....	18	21	22
COPPER :			
Anaconda (£5).....	178	145	137
Arizona (5s.).....	41	38	36
Cape Copper (£2).....	130	112	102
Chillagoe (10s.).....	3	1	1
Cordoba (5s.).....	7	7	7
Great Cobar (£5).....	93	23	17
Great Fitzroy (5s.).....	1	3	2
Hampden Cloncurry.....	52	38	36
Kyshtim.....	65	62	60
Messina (5s.).....	23	27	30
Mount Elliott (£5).....	162	93	80
Mount Lyell.....	23	25	25
Rio Tinto (£5).....	1517	1540	1425
South American Copper (2s.).....	34	32	32
Spassky.....	83	60	56
Tanganyika.....	53	44	38
Tharsis (£2).....	127	147	140
Whim Well.....	23	12	10
LEAD-ZINC :			
BROKEN HILL :			
Amalgamated Zinc.....	35	27	26
British Broken Hill.....	50	38	36
Broken Hill Proprietary (8s.).....	46	35	33
Broken Hill Block 10 (£10).....	41	34	33
Broken Hill Block 14 (25s.).....	9	7	7
Broken Hill North.....	161*	53*	50*
Broken Hill South.....	171	146	146
Sulphide Corporation (15s.).....	30	24	24
Zinc Corporation (10s.).....	18	17	17
TIN :			
NIGERIA :			
Abu (5s.).....	—	12	10
Bisichi.....	23	17	16
Jos (5s.).....	7	8	7
Kaduna (5s.).....	25	18	15
Naraguta.....	26	36	33
Nigerian Tin.....	22	27	18
N. Nigeria Bauchi (10s.).....	5	3	3
Rayfield.....	16	17	11
Ropp.....	61	135	127
OTHER COUNTRIES			
Aramayo Francke.....	32	35	33
Biscuits.....	9	7	6
Cornwall Tailings.....	36	20	17
Dolomath.....	25	20	17
Geevor (10s.).....	16	21	12
Gopferk.....	30	28	28
Marachi.....	28	21	20
Roosburg.....	31	30	28
Tekka.....	70	67	62
Tromoh.....	75	46	42

* Capital arranged during year.

PRÉCIS OF TECHNOLOGY

Leaching Copper Ores in Montana.—During the last year or two the wet methods of extracting copper have received attention in the Butte district of Montana. We have already described Laist's process now being tried at Anaconda, in our issue of February and June and the plant for precipitating copper from the mine-waters of the same group of mines, in our issue of September. Two other installations have recently been started in the same district for extracting copper from oxidized ores. One is at the Butte-Duluth mine and the other at the Bullwhacker. These plants have been described by Peter E. Peterson in the *Mining and Engineering World* (of Chicago) for September 6, and October 4 respectively. We give herewith a full abstract of the article on the Butte-Duluth plant. Owing to exigencies of space, our abstract of the Bullwhacker article is held till next month.

The ore treated at the Butte-Duluth plant is a decomposed granite containing 2% or more of copper as malachite, azurite, chrysocolla, and cuprite. It is mined by open-cut, crushed to pass $\frac{1}{2}$ in., and delivered to leaching vats, where it is treated with 10% sulphuric acid solution for 24 hours. At the end of that time, the solution contains from 5 to 8% sulphuric acid and about 2% copper. It is then withdrawn, and passed through heating cells, in which its temperature is raised to 60° C., and from there to electrolytic cells, where the sulphuric acid is partly regenerated and some of the copper deposited. The regeneration takes place to the extent of 1% acid, and about one-fifth of the copper is deposited. The solution is sent to the sump where its strength is made up to 10% by the addition of further acid, and it is then returned to the leaching vats. It will be seen that after starting, the solution continually contains from 1.6 to 2% copper. After leaching, the tailing is washed. The first wash-water, limited in extent, is added to the circulating solution, and at the same time an equal quantity of the latter is withdrawn; after the latter is run over ore to use the acid contained in it, it is passed over iron to recover the copper. The following wash-waters are passed over iron direct. The acid consumption is about 3.5 lb. H_2SO_4 per lb. of copper produced, and the power consumed is approximately 1 kilowatt-hour per lb. of copper. At the present time the production is about 1 ton of copper per day. Additional plant is to be erected, so that in a short time 100 tons will be produced per month.

There are six V-shaped leaching vats, each 24 ft. long, 6 ft. deep, 8 ft. wide at the top, and 2 ft. wide at the bottom. They are built of wood, two being lined with antimonial lead, and the other four painted inside with tar paint. Each vat has four discharge gates in the bottom. They are raised 6 ft. from the ground, for the easy discharge of the tailing. No filter-bottom is used, and the solution flows out through a 4-in. hole in the end. In addition to the V-shaped vats, a large rectangular vat has been erected, the object being to ascertain the best shape for the vats. This is 70 ft. long, 12 ft. wide, and 6 ft. deep, and lead-lined. The special feature is the discharge. There are 12 discharge openings, which are closed from the inside by large wooden plugs, extending through the ore and removable by chain-blocks. The bottom has a filter composed of 2 in. boards with $\frac{3}{8}$ in. holes. It is found that with the plugs less loss of solution is experienced than with doors, though the time occupied in discharging the tailing is greater.

Twelve electrolytic cells are in use, each 8 ft. long, 30 in. wide, and 39 in. deep. They are lined with

hard lead, weighing 4 lb. to the square foot. In each cell there are 20 anodes of hard lead weighing 10 lb. to the square foot. The copper cathodes, of which there are 19, weigh from 2 to 3 lb. when first placed in the cells. The cells are arranged in pairs, three in a line. The solution passes through three cells, each set of three cells depositing copper from one-quarter of the circulating solution. The anodes and cathodes are suspended from copper bars $\frac{5}{8}$ in. diam., the bars resting on the main bus-bars. The anodes and cathodes are electrically connected in multiple, and the cells in series. The current density is from 12 to 13 amperes per square foot. The electrolyte in the cells is covered with black oil to prevent escape of fumes into the room. While the oil is effective in preventing escape of the fumes, it necessitates the dipping of the cathodes in hot water to prevent adhesion of the oil when introducing them into the cells. As already mentioned the cathodes, when first placed in the cells, weigh from 2 to 3 lb. They remain in the cells from 7 to 10 days, and on being removed weigh from 40 to 60 lb. The finished copper is almost pure, assaying 99.96% copper. The 16 new electrolytic cells which will soon be placed in commission are of the same dimensions as the old ones, and they differ only in that the solution flows from side to side, and thus each cathode receives solution of the same analysis. About the only difference this will make will be to give the electrolyte the same resistance between cathode and anode, which in turn will tend to ensure the deposition of the same grade of copper on each cathode. Sulphuric acid is an expensive item, for it costs \$27 per ton. It is the intention to erect a sulphuric acid plant, using sulphur in the burners.

Tin-Dressing at Geevor.—At the November meeting of the Institution of Mining and Metallurgy, a paper was read by Horace G. Nichols, describing the tin-dressing plant at the Geevor mine, St. Just, Cornwall. Mr. Nichols had been commissioned by the directors of the Geevor company last spring to ascertain the results obtained by the plant which had been designed by R. Gilman Brown and W. C. Madge. These engineers had desired to try modern inventions connected with grinding, classifying, and concentrating, with the object of testing the principle of step-grinding and step-classification as applied to tin ores, hoping thereby ultimately to increase the percentage of recovery, which is admittedly low in Cornwall. The paper presented by Mr. Nichols gave the results of his investigations, but it does not cover the whole ground, seeing that his description of the operations ceases with the production of the first set of concentrates, and does not describe the roasting and subsequent second set of concentration operations. The plant erected under the advice of Messrs. Gilman Brown and Madge included Hardinge mills, Richards-Janney classifiers, Callow dewaterers, and Deister tables. Readers of the paper will wonder why treatment on Frue vanners is included in the scheme. It must be explained that a large amount of plant was already on the spot when the engineers took charge and that the directors desired that use should be made of it. Mr. Madge, at the meeting, stated that these limitations interfered with his plan of crushing and concentration and that the plant as at work did not meet his ideal by any means. We understand that the method of treatment and the figures for the performance of the plant as described in the paper have not been accepted by the directors, and that sweeping changes have been made since May. In fact the system of treatment in vogue at Dolcoath has been substituted. We may take it that Mr. Nichols' figures

are substantially correct, and that they have not been accepted for reasons beyond his control. We reproduce the flow-sheet herewith and give particulars of the plant. It is notable that Mr. Nichols gives an assay of every product and accounts for all the ore and all the cassiterite contained in it. The figures have been reduced to a uniform standard of black tin containing 66.66% metal, in order that the comparisons between the products at the various stages may be made on a common basis. The tonnage treated was 100 tons of ore per day. Three Holman air-cushion stamps (A) are kept stamping at 142 drops per minute, crushing through No. 32 Cornish mesh (diameter of aperture 0.053 in.) perforated screens. The pulp, after passing an automatic sampler, is lifted by the first bucket elevator (B) travelling 283 ft. per minute, and passes to the Richards-Janney classifier (C), in which the first spigot gives 300 discharges per hour, the second 225, and the third 150. The first spigot discharge passes through a small dewatering tank to the Hardinge tube-mill (D) and thence back to the elevator. The second spigot discharge is the feed to the first row (F) of three vanners which are speeded to about 3 ft. belt-travel per minute, and dropped 5½ in. at the tail end. The third spigot discharge is the feed to the second row (G) of Frue vanners speeded to about 2½ ft. per minute, with a 4½ in. drop, and the overflow from the classifier passes to the two small Callow tanks (E) from which the underflow forms the feed to the third row (H) of Frue vanners, which are run as nearly level as possible and speeded to pull a not too clean concentrate in order to get a tailing lean enough to run to waste. The overflow from these Callows passes to the three 8-ft. Callows (P). The tailing from the first two rows of vanners is re-ground in the grinding pans (K), and with the slime vanner-tailing (third row) is elevated, passing to the two-compartment Richards-Janney classifier (N), from which the two spigot discharges respectively feed the two Deister sand tables (R), producing a concentrate only, and a tailing run to waste, while the overflow also passes to the 8-ft. Callows. The underflow from the Callows feeds 4 Deister slime-tables (S). The overflow passes to two more pyramidal thickeners (T), the underflow feeding the fifth slime-table and the overflow going to waste. The five slime-tables produce a concentrate, a middling, and tailing which is run to waste. The middling all passes to the dipper-wheel (W) which elevates it to two small thickeners in parallel (Y), the overflow from which passes to a larger pyramidal thickener (Z). The underflow from this dewaterer is returned to the dipper wheel, and the thickened middling is fed to the sixth slime-table (S¹), the middling of which is close-circuited by passing back to the dipper-wheel. Thus the slime-tables ultimately produce only a concentrate, which goes to the calciner.

The products are numbered 1 to 30 in the flow-sheet and the table on the next column gives the respective tonnages and contents in pounds of black tin, based on a daily treatment of 100 tons containing 3600 lb. black tin by chemical assay.

It will be seen that numbers 20, 21, and 30 represent the concentrate, and 22 and 25 the final waste. The concentrate weighs 2.631 tons and contains 2830 lb. of black tin. The tailing aggregates 97.369 tons containing 770 lb. black tin. The recovery is therefore 78.6%, while 21.4% is lost in the tailing. The loss in the tailing is therefore 7.7 lb. black tin. It must be remembered, however, as mentioned above, that this is only part of the process, and that further losses must occur in the subsequent roasting and re-concentration. The figure for the concentrate, 2.631

tons containing 2830 lb. black tin, show that it only averages 48% black tin, or 32% metallic tin. In order to obtain a commercial product, it would be necessary to dress up to a much higher percentage of metallic tin, and in so doing it is a matter of common knowledge that substantial losses occur.

One of the points raised in the discussion was in connection with the initial fine crushing, and some speakers argued that a coarser first product should be obtained. Mr. Madge, however, said that the grains of cassiterite are so small as to require this fine grinding, and that it was necessary even to re-grind the first spigot discharge of the classifier. The question was also asked why this re-ground product was returned to the same classifier, to which Mr. Madge said that it was necessary to have the particles fine enough to pass over to the second compartment, and there was no special reason why a separate classifier should be used.

EXPLANATORY TABLE FOR GEEVOR FLOW-SHEET.

	Tons	Content black tin lb.		Tons	Content black tin lb.
1	35	800	16	74.788	845
2	35	800	17	30.2	302
3	135	4300	18	25.4	280
4	25	1350	19	19.188	263
5	37	1296	20	1.712	2285
6	38	954	21	0.69	356
7	0.72	1002	22	54.91	226
8	0.666	940	23	20.5	287
9	0.326	343	24	20.271	100.5
10	24.28	348	25	42.459	544
11	36.334	356	26	17.188	383.5
12	14.174	141	27	20.188	446
13	14.5	484	28	5	60
14	23.5	470	29	5	62.5
15	60.614	704	30	0.229	189

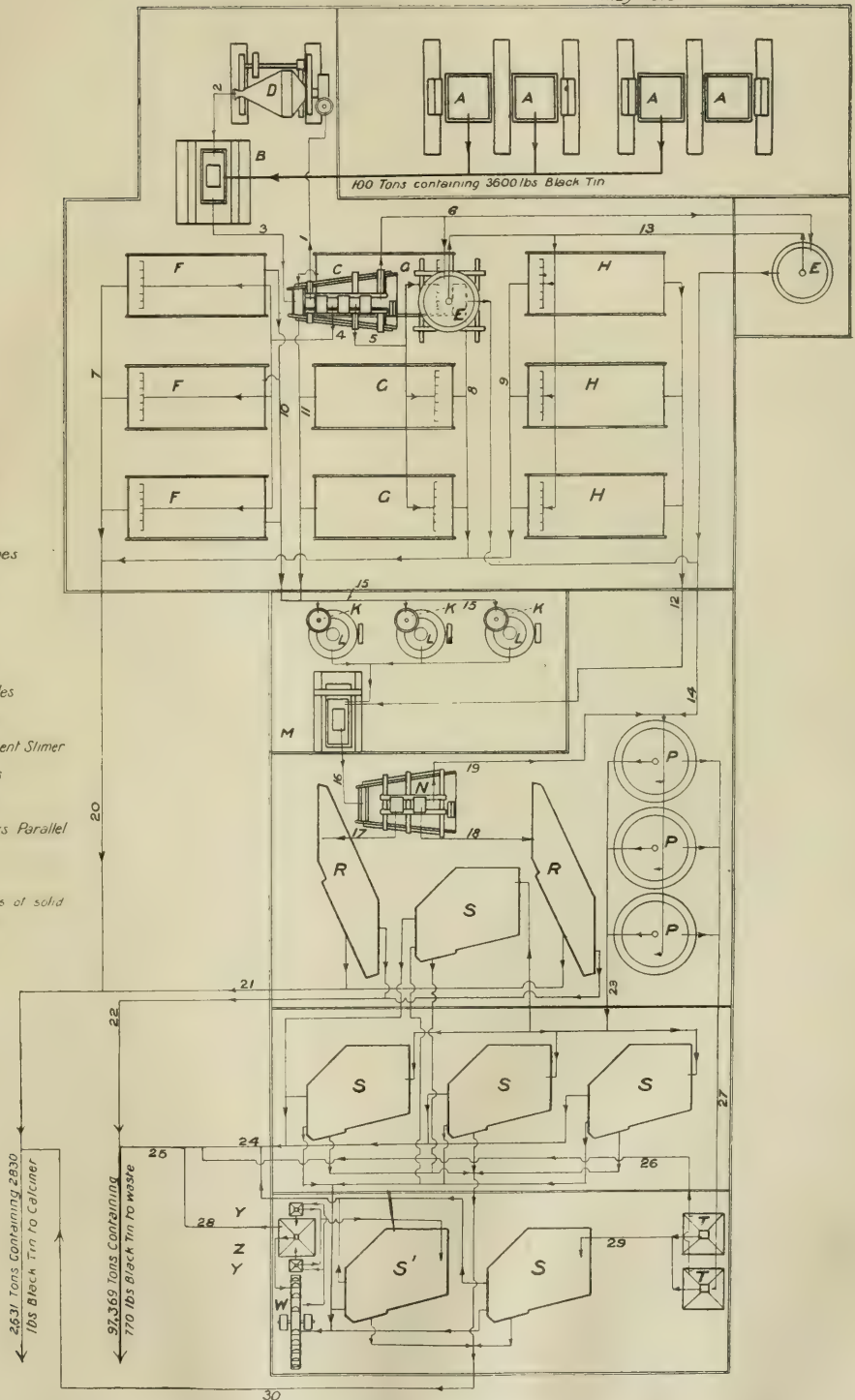
Econom.—During the last few months much has been heard of the petrol-substitute christened 'econom,' and a public company has been formed to manufacture it. The patents acquired are numbered 14,671 and 22,561 of 1907, the inventor being Rudolf Hense, of Charlottenburg. Applications have been made for further patents, the numbers being 6643 and 20,188 of 1913. Patent 22,561 of 1907 contains the gist of the invention as far as disclosed in the prospectus and accompanying reports, so we give an abstract of it herewith, holding that any invention tending to improve the market for oil is of importance to a large number of our readers.

The object of the invention is to produce a mixture of a hydrocarbon oil of comparatively low volatility with a hydrocarbon of comparatively high volatility in order to produce a combustible liquid that will volatilize as a whole within the limits of the temperature of the carburettor of an internal-combustion engine. An example of the heavy hydrocarbon is kerosene, and of the light one benzol. To this mixture is added a caustic alkali, then a solution of a material rich in carbon such as gum or resin, and a solution of a nitro-compound such as picric acid, the latter to act as an oxidizing agent. This mixture is purified with sulphuric acid and the solution of a salt such as sodium sulphate, and fractionally distilled. The inventor gives an example of the procedure. One hundred kilograms of ordinary kerosene of specific gravity 0.83 to 0.87 are mixed with 0.5 kg. caustic potash and 20 kg. benzol of specific gravity 0.9. After having been vigorously stirred, the mixture is allowed to rest for about 6 hours, whereupon it will be found to have a

May 1913.

- A Stamps
 B Elevator
 C Classifier.
 D Tube Mill
 E Callow Tanks
 F 1st Row Vanner
 G 2nd ..
 H 3rd ..
 K Dewatering Cones
 L Pulverizers
 M Elevator.
 N Classifier.
 P Callow Tanks.
 R Deister Sand Tables
 S .. Slimers
 S' Middling retreatment Slimer
 T Dewatering Tanks
 W Dipper Wheel
 Y Dewatering Tanks Parallel
 Z " "

"Tons" refers to tons of solid per 24 hours



FLOW-SHEET OF GEEVOR MILL AS WORKING IN MAY.

specific gravity below 0.8 and to contain as a sediment the matter separated from the kerosene by the caustic potash. If this mixture were distilled it would separate into its components, but if there be first added to it a material rich in carbon like a gum or a resin, and a nitro-compound, preferably picric acid, the liquid will distil uniformly. Accordingly, 1 kg. of a common gum resin or waste amber is dissolved in 1 kg. light petroleum or benzol and 1 kg. of picric acid in 1 kg. of light petroleum or benzol; these two solutions are mixed and added to the mixture of hydrocarbons. The solutions may be added separately, but if so the solution of the gum resin should be added first, as otherwise the resin is apt to be precipitated. The mixture is then subjected to a purification by means of sulphuric acid followed by clarification by a solution of a salt such as sodium or magnesium sulphate. When the mixture has stood for about 24 hours, the oil is separated and mixed with about 100 grams of amyl acetate to disguise the odour. Finally the oil is fractionally distilled to separate the lighter portion, which is suitable as a fuel for internal combustion engines, from the heavier portion, which is useful as a solvent for fats and as a substitute for turpentine. The fractional distillation is not accompanied by a separation of the liquid into its original components. For instance, if the lighter hydrocarbon originally added to the heavier one amounted to 20% of the latter, the proportion of the final mixture which will distil at the temperature of distillation of the lighter hydrocarbon will be 40% of the original heavier hydrocarbon. In practice that which distils below 250° C. may be used as a fuel for internal combustion engines.

A Kalgoorlie Mine-Survey.—In the *Monthly Journal* of the Chamber of Mines of West Australia, V. H. R. Murray, surveyor to the Golden Horse-Shoe Estates, describes the survey undertaken for the Ivanhoe South Extended at their main shaft. Subsequently the Golden Horse-Shoe purchased the property and this shaft then became known as the No. 3 shaft. This survey is notable because of the short base (2.31 ft.) allowable in the shaft, and the depth (2000 ft.) to which the azimuth had to be transferred direct from the surface in one operation. Usually in the larger mines the azimuth could be carried down from the various levels as the workings were developed, but the conditions in this case were not favourable to such procedure. The size of the shaft on the surface was 9 ft. 4 in. by 5 ft. 2 in. over all, and was divided into two compartments each 4 ft. 2 in. by 3 ft. 6 in. in the clear. Two styles of timbering were used. For the first 400 ft. 'crib' or 'box' timbering was adopted, while from this depth to 2000 ft. 'square-set' timber was used, and the shaft was widened to 4 ft. 10 in. in the clear. At 100 ft. and 400 ft. narrow cross-cuts were driven east to the boundary; at 800 ft. a fair amount of cross-cutting and driving was done on each side of the shaft; at 1500 ft. only a small plat was cut on the east side. It was decided to drive in a southeast direction to the boundary of the Golden Horse-Shoe main lease and then to cross-cut east across the property with a view to developing the lodes that might be cut, and also to cross-cut under the main shaft, which was only 1600 ft. deep at this time, in order to be ready for a connection when it reached 2000 ft. The most reasonable method of transferring the azimuth to the 2000-ft. level appeared to be by lowering two wires direct from the surface, the plat at 100 ft., 400 ft., 800 ft., and 1500 ft. being too small for conducting deeper operations. To make use of an instrument with a side or top telescope to transfer the azimuth direct was impracticable, as the

size of the shaft was unsuitable. If a sight could have been taken downward, the falling salt water would have rendered a sight upward impossible. The traverse was started from the northeast corner of Lease 351 E and the datum was the eastern boundary of the same lease. This boundary has a true bearing of 321° 38', but for all surveys performed on the Golden Horse-Shoe Estates, it is assumed to be 360°. So that with the addition of 38° 22' to all bearings a system of co-ordinates has been established with the northeast corner (A on sketch) as origin. This system has been of great service, as most of the principal workings are alongside the eastern boundary, and little calculation is required when engaged on a survey underground to determine on the spot the distance of any point from the boundary, and plotting is facilitated, a protractor being unnecessary. The traverse was continued to a point opposite No. 3 shaft and a bearing set out across the hauling compartment. The north compartment was used for baling and was not suitable. The lengths of the traverse lines are short, but owing to the number of buildings on the leases short sights could not be avoided.

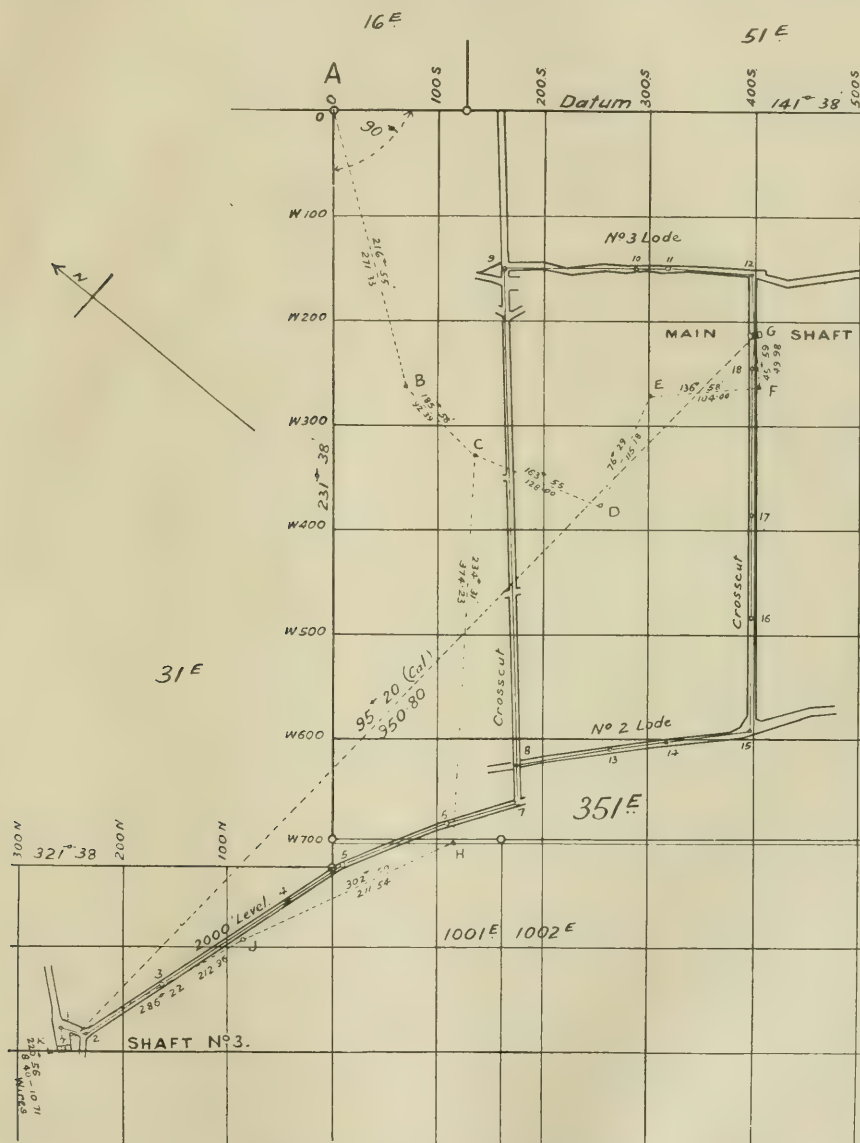
The instrument used was a 5 in. theodolite on camera legs, and fitted with a traversing head. The measurements were made with a Chesterman steel band, $\frac{1}{8}$ in. wide, and divided into feet and 100ths. The plummets were of lead and cone-shaped, 10 in. long and $4\frac{1}{2}$ in. diameter at base, each weighing 28 $\frac{3}{4}$ lb. Four wings of flat galvanized iron were let into the plummets along their whole length, projecting 2 in. The wire was 20-gauge steel, each wire being in one piece weighing 6 $\frac{1}{2}$ lb. The wires were run off reels over grooved pulleys fitted on a bed of boiler plate and firmly screwed to a timber staging. These wires were placed as nearly in the line as possible for a start, the final adjustment being made with screws which were attached to the pulleys. All sights were taken to points below the staging. Weights of 2 lb. each were attached to the wires to lower them, the easterly one being lowered first. When the arrival of the wire was signalled from the level below, the reel on the surface was clamped, then the wire below was pulled to one side and made fast, while the other wire was lowered. This was done to minimize the risk of entanglement. At the 2000-ft. level two drums of oil were placed to receive the plummets, and to keep the dropping water from disturbing the oil, cone-shaped lids were made to fit the drums. These lids were each made in two pieces, and hinged, so that they could be placed on the drums after the plummets were immersed in the oil, without interfering with the wires. The lids, when in position, allowed the wires to hang clear through a 2-in. hole. As the hole was in the centre, it served as an index as to whether the plummet was or was not in contact with the sides of the drum. When the second wire reached the level, the work of attaching the heavy plummets was proceeded with, each plummet being adjusted separately, and the raising or lowering of the wires being done from the surface according to the signal from below. When the wires were hanging with the heavy plummets in the oil, the bearing on the surface was carefully checked and a descent made on the baling tank. The work of placing the theodolite in line with the wires was then performed. It was a tedious job, and required much patience; but the traversing head helped considerably and the lids covering the oil-drums kept the plummets from being disturbed and allowed them to come to rest quickly.

Although the atmosphere was humid and the size of the shaft-compartment small, a satisfactory alignment

was made, the bearings were established in the drift, and the survey continued therefrom.

All difficulties had not, however, been surmounted, as when the drift was about 300 ft., a lode was cut and driven on, which took the drift from its intended course, and several renewals of stations had to be

principal ones (marked No. 2 and No. 3 in the illustration) were driven on for a considerable length. The second cross-cut was driven from No. 3 lode to where the main shaft was expected. It was also connected by cross-cut from No. 2 lode. The main shaft subsequently holed to the 2000-ft. level, and for all mining



SURVEY AT IVANHOE SOUTH EXTENDED.

made owing to the plugs being shot out. The cross-cuts were driven on bearings marked by lines hanging from plugs in the back. These lines are generally placed from 20 ft. to 30 ft. apart according to conditions, and renewed when the face of the cross-cut progressed to 100 ft. from the front line. Owing to heavy firing and falls of ground, numerous renewals were required. Several lodes were cut and driven on; the

purposes the result was satisfactory; from a surveyor's point of view it did not appear an absolutely accurate connection. It was not until some time later that an opportunity occurred to check the survey by means of hanging a wire down the main shaft from the surface. Then it was found that the survey from the transferred azimuth was 8' in error. The author gives the calculation sheets of the original and adjusted traverses.

Zinc Metallurgy at Broken Hill.—In the *Mining and Engineering Review*, F. W. Reid describes the zinc-distilling plant of the Broken Hill Proprietary company, at Port Pirie, South Australia. The first of the 10 distilling furnaces was started early in 1910, and at the present time 8 are in commission. The zinc concentrate treated contains on an average 46% zinc, 8% lead, and 13 oz. silver per ton, together with about 30% sulphur. The sulphur content is reduced to 1% in Hegeler roasting furnaces, several improvements in detail having been introduced on the spot to adapt the furnace to the nature of the work required. Mr. Reid also describes the plant for making the retorts, and then proceeds to give details of the distilling plant. The furnaces are of the Rhenish type, having two tiers of retorts set back to back. Each tier has three rows of retorts one over the other, 24 in each row, making 144 retorts in each furnace. The retorts are 5 ft. 6 in. long, and 13 in. by 7 in. elliptical cross-section, and set slightly inclined toward the back. Gas-firing is employed, there being a producer for each furnace. The air-supply is pre-heated on the counter parallel-current system, and is forced by a fan through a series of flues and round the furnace itself before reaching the burners. The burners, four to each furnace, are in the form of large Bunsens, built in the hearth of the furnace between the two tiers of retorts. They are 18 in. diam., with gas inlet 8 in. diam. at the bottom and air-ports at the side. When the retorts have been placed in position, the condensers are attached to them through their clay-smeared bevelled edges. The condensers are simply half-length retorts. They rest on the tiles which carry the front end of the retorts. The charge is introduced after the condensers are in place. For the two upper rows this consists of roasted zinc concentrate, to which has been added 30% fine coke and 15% fine coal. Some condenser chippings and over-size blue-powder are also added. The bottom rows of retorts, which are not so strongly heated, are charged mainly with dross, that is, a mixture of coke, blue-powder, and metallic zinc, scraped from the condensers during tapping operations.

After charging, the ends of the condensers are stopped by luting-on cast-iron tiles, lined with fireclay on the inside and provided with a hole for outward passage of vapours. Over a projecting collar surrounding the hole is fitted the small end of a conical sheet-iron nozzle or prolong, as it is in some places called, the other end of which is supported by a movable bar resting on brackets on the front of the furnace. The prolongs, by their additional cooling effect, serve to collect the zinc in the vapours escaping from the condensers, it being retained in the form of blue powder. The carbon monoxide formed during the reduction of the zinc escapes at a small hole at the outer end of the prolong, where it burns with a flame tinged greenish-white by a small quantity of vapour of zinc burning to oxide. When the prolongs have been fixed in position the furnace is fired. The temperature is taken at hourly intervals by means of a Wanner pyrometer. It is raised gradually until it reaches a maximum of 1325° to 1350° C. An hour or two before the day shift comes on, the prolongs are removed and the contained blue powder collected. The furnace is then ready for tapping. The tile on the end of the condenser is removed, the molten zinc allowed to run into a cast-iron ladle placed to receive it, and the condenser thoroughly scraped to remove all zinc and dross. The contents of the ladle are skimmed and the spelter poured into moulds. Raking-out the retort residue is the next operation. For this purpose counterbalanced sheet-iron aprons are pulled down in front of the

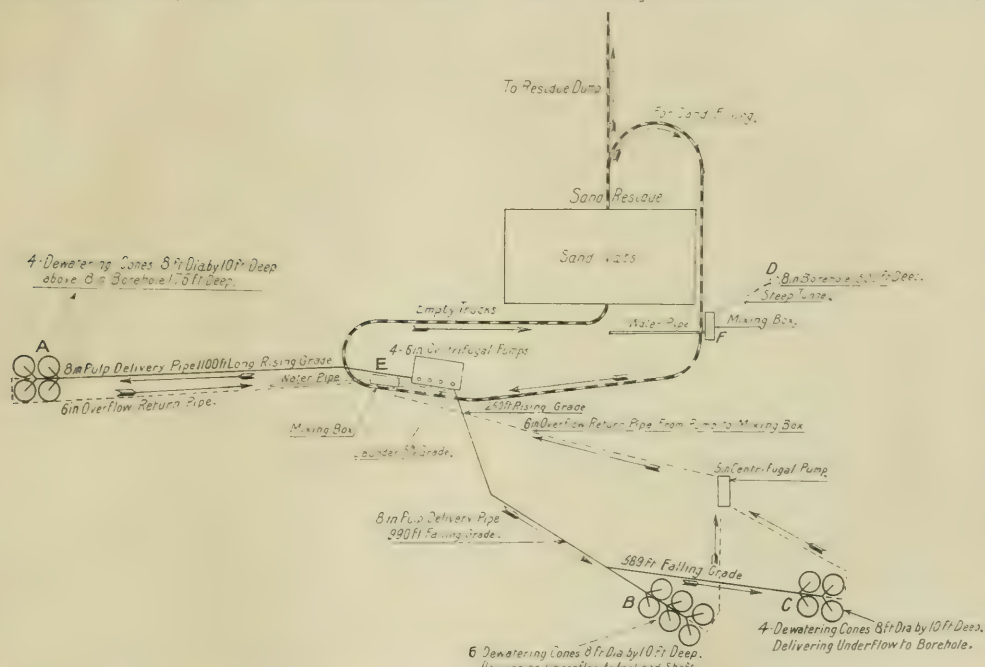
furnace and rakes inserted through openings opposite the retorts. The residue, deflected by the apron, falls through an opening in the floor close to the front of the furnace, and run by a chute into trucks below. It is sent to the lead blast-furnace for recovery of the lead and silver contents. The furnace is next tested for cracked retorts. This is done by simply turning-on the gas, when cracks can be detected by the flame coming through into the interior of the retort. Damaged retorts are replaced by new ones, and after fitting the latter with condensers re-charging is commenced. The cycle of operations on the furnaces occupies 24 hours. The capacity of each furnace is 5 tons of roasted material per 24 hours. The zinc recovery in spelter and marketable blue powder is said to range from 80 to 85%.

The blue powder averages about 12% of the total furnace product, and is of excellent quality, containing 92½% metallic zinc. It is screened through a 100-mesh screen, and boxed for export to San Francisco or Japan, its two markets. Blue powder is used in the dry galvanizing process known as 'sherardizing,' and also finds an application in the Merrill process for precipitation of gold from cyanide solution.

The spelter contains 2 to 3% lead, and is sent to the refinery, where it is liquated in a reverberatory furnace. The charge is about 20 tons. The lead sinks to the bottom, and is allowed to accumulate for a week or more before it is tapped. It contains 0.7 to 0.8% zinc. The spelter is ladled out at one end of the furnace, having first to pass under a baffle-plate, which, dipping into the bath, holds back the dross. The latter, which is small in quantity, is skimmed off and returned to the zinc plant. The spelter, now ready for export, contains less than 1% lead, and approximates 99% metallic zinc.

Stope-filling at Simmer & Jack.—The *Journal* of the Chemical Metallurgical & Mining Society of South Africa contains a paper by W. A. Caldecott and O. P. Powell on the stope-filling method as adopted at the Simmer & Jack mine. The authors are respectively consulting metallurgist to the Gold Fields group and manager of the mine. Previous papers on stope-filling have been read before the society, notably those by Edgar Pam and O. P. Powell in June 1910, and by A. R. Hughes in October 1911. We would mention also Mr. Pam's article in this Magazine for October 1911. So many improvements and modifications in practice have been introduced during the last two or three years that a description of the Simmer & Jack plant as finally settled and a discussion of general principles are welcome. At this plant current sand and not dump material is used for the filling, and it is sent down bore-holes as a thickened pulp to distributing launders below, in contradistinction to the more usual way of delivering it to the stopes in a dilute condition through pipes. The sand-residue is discharged from the vats into trucks and delivered to mixing-boxes, where water containing permanganate of potash is added to it so as to bring it to the consistency of freely flowing pulp. The permanganate is added to render any remaining cyanide innocuous by changing it into cyanate. The pulp is pumped by centrifugal pumps to dewatering cone-classifiers situated immediately over the various bore-holes. The thickened underflow passes down the bore-holes to distributing launders, and the overflow is pumped back to the mixing-box. The accompanying plan shows the arrangement diagrammatically. It happens that the bore-hole *D* is close to the sand-vats, so no pumping is required for it. Some of the trucks are dumped into the mixing-box *F* and the pulp discharged down

must be so arranged as to use the least amount of water. With less water throughout the plant it is not so necessary to economize by having a rapid delivery of the pulp, and consequently the amount of abrasion is much less. At the Simmer & Jack one of the delivery pipes has been in use with thick pulp for three years without any appreciable wear. The authors point out the advantages of using current sand instead of dump material. For one thing the current sand would have to be dumped and the dump material excavated, and by using the current sand these operations are eliminated. Then the dump material has weathered and sulphuric acid formed by the oxidation of the pyrite; lime has to be added to neutralize it. Also the dumps usually contain colloidal slime, the presence of which is undesirable in the packs for the reason already mentioned. At the Simmer & Jack



cyaniding is watched carefully for the sake of the stope-filling operations as well as for the proper percolation of the sand in the vats. Not only will slime clog the delivery of the pulp, but it will prevent the water draining from the packs. It is necessary that the packs should not transmit rock-pressure laterally. The sharp edges of the sand must always be in contact with one another, so that their friction will cause a resistance to lateral movement. In using this system, the distribution of the sand below must be maintained continuously and the expense of dumping and re-handling avoided. To do this requires a thoughtful pre-arrangement of underground operations. On the amount of water used in any sand-distributing device depends the size of the plant and the power required. In the present case the thick pulp sent down the bore-holes effects an economy in this direction. The lowest ratio of water to solids possible must be used in the pipes from the pumps to the cones. This latter will depend on the grade of the pipes, and the grade of the pipes must be regular. Underground the launders

Air instead of Water in Diamond-drilling.—The October *Bulletin* of the American Institute of Mining Engineers contains an article by Ralph Wilcox describing the diamond-drilling done by him at Miami, Arizona. The feature of this work was that air was pumped through the drill-rods instead of water, and the operation conducted dry instead of wet. At Miami, the copper-bearing schists are so weak in structure that the drill-holes cave readily. The author was of opinion that the water used in the drill greatly assisted this caving, so he decided to try air instead of water.

though admitting that the decreased speed of sinking and increased consumption of diamonds would be serious disadvantages.

After experimenting, he found that it was practicable to substitute air for water, forcing the air down the hollow rotating rods in the same manner as is done with water, the air passing out round the bit, which is thus cooled, and ascending on the outside of the rods to the collar of the hole, carrying the borings in as satisfactory a manner as had been done by the water, but without the caving of the sides of the holes. When water was encountered in drilling, it was forced up to the collar, as it would have been had water been used in the drilling, but, with the correspondingly decreased flow, there was relatively less washing or caving of the sides of the holes. The only change necessary in the arrangement of the drill is that a cross instead of a tee is used at the collar of the hole. A tightly woven jute bag is attached to one arm of the cross, for collecting and filtering the sample; and when drilling in dry ground a jet of water is attached to the opposite arm of the cross, to collect the dust and wash the sample into the bag. The rods rotate through a stuffing-box attached to the upper opening of the cross. The distention of the jute bag by the issuing air indicates the operating conditions as sufficiently as did the flow of water when using water in the drill-hole. The small percentage of core recovery rendered it necessary to rely almost entirely upon sludge samples. Great care was taken in recovering these, which were all weighed to detect the presence of caving. A winze has lately been completed which was sunk on one of the drill-holes for the purpose of checking the sludge samples; the samples from the winze and the samples obtained in the drill-holes checked accurately. Experience has shown that the refrigerating action of the air in expanding round the bit is effective in cooling the bit and that the diamond consumption has not increased. It has not been found necessary to decrease the speed of rotation of the bit.

CURRENT LITERATURE.

Stope-Filling.—In the *Iron & Coal Trades Review* for November 7, O. Putz discusses the best form of cross-section for pipes and their linings used in hydraulically conveying filling to exhausted stopes.

Sinking at Charters Towers.—The *Queensland Government Mining Journal* for August contains the full text of Thomas Mills' application for a subsidy wherewith to sink to depth at Charters Towers, and of the report on the subject by E. O. Marks, Assistant Government Geologist. Owing to the unfavourable nature of this report, the government did not entertain Mr. Mills' proposition.

Drilling at the Nevada Consolidated.—The *Mining and Scientific Press* for October 25 quotes from the *Keystone Magazine* a detailed description of the drilling of blast-holes at the open-cut workings of the Nevada Consolidated 'porphyry copper' mine at Ely, Nevada. Vertical holes 6 in. diam. are drilled vertically down the banks. After blasting, the broken rock is removed by steam-shovel into cars.

Concentration of Mercury Ores.—In the *Engineering and Mining Journal* for October 25, G. V. Northey describes the concentration plant at the Manzanita Quicksilver company's mine in Colusa county, California.

Slime-Table. In *Metallurgical and Chemical Engineering* for November, A. H. Martin describes

the Darrow-Hambric multiple-deck slime-table in use in Californian gold mines.

Lead Salts in Cyanidation.—The *Mining and Scientific Press* for November 15 publishes an article by M. W. von Bernewitz containing a compilation of information as to the practical results following the use of lead salts in cyanide treatment.

American Metallurgy.—The *Mining and Scientific Press* for November 8 contains a translation by Herbert Haas of Ferdinand Heberlein's article entitled 'An Excursion to North American Smelting Works' that appeared in *Metall und Erz*.

Zinc Metallurgy.—In *Metallurgical and Chemical Engineering* for November, F. L. Clerc discusses a proposed method of condensing zinc vapour to liquid form and so avoiding the production of blue powder.

History of Converter Practice.—In the *Mining and Scientific Press* for October 25, Herbert Haas discusses some aspects of early work in connection with the application of bessemerizing to copper ores and matte. He shows that John Hollway's experiments were connected with ore not matte, and that they would have led to pyritic smelting rather than what is known as bessemerizing in copper metallurgy. He also gives credit to the work of Paul David in association with Manhés.

The Herreshoff Furnace.—The *Mining and Scientific Press* for November 1 describes the latest form of Herreshoff furnace, as erected at the smelting works of the Arizona Copper Co., and the Calumet and Arizona Co. In its original form the Herreshoff furnace was a modification of the McDougall intended to adapt it for the manufacture of sulphuric acid.

Electric Furnaces.—*Metallurgical and Chemical Engineering* for November contains a lengthy article by Woolsey Mc A. Johnson and George N. Sieger on the design, characteristics, and commercial application of electric furnaces.

Waste Heat of Reverberatories.—In the *Mining and Scientific Press* for October 11, S. S. Sorensen discusses the relative advantages and disadvantages of the Stirling and Babcock types of boilers when used for heating steam from the waste gases of reverberatory furnaces.

Canadian Gold Ores.—At the November meeting of the Institution of Mining and Metallurgy J. B. Tyrrell presented a paper entitled the 'Occurrence of Gold in Ontario.' He described in particular the geology of the Swastika district. He holds that the distinguishing feature of the gold-bearing veins is their close association with intrusive masses of diorite or felspar porphyry rich in soda or soda-lime felspar.

Radium.—The *Mining Journal* for November 22 publishes an article on the South Terras uranium mine in Cornwall, owned by the Societe Industrielle du Radium, and on the method of extracting radium compounds from its ores, as conducted by Professor Danne, at Gif in France.

Oxidation of Coal.—The *Colliery Guardian* for October 31 contains a translation from *Annales des Mines* of an article by P. Mahler on the oxidation and spontaneous heating of coal.

Sulphur in New Zealand.—The *Engineering and Mining Journal* for November 1 contains an illustrated article on the White Island sulphur deposit, off the coast of New Zealand. A short note on the subject was given in our issue of April last.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

Early Days on the Yukon. By William Ogilvie. Cloth, octavo, 320 pages, illustrated. London: John Lane. Price 5s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

Among the names indissolubly linked with the story of the Northwest is that of William Ogilvie. It was fitting that he should leave a record of his work for civilization in the great wilderness of the Canadian hinterland. He tells the story simply. At first the lack of either literary arrangement or adornment is disappointing, but as successive pages are turned the reader begins to appreciate the modest chronicle and to feel its simple dignity—as of the Yukon itself, sweeping in silent flood, through the frozen vastness of a great lone land. A surveyor and mathematician by training and profession, he relates how in 1887 he was commissioned by the Canadian government to lead an expedition sent from British Columbia to define the 141st meridian where it crossed the Yukon. The book starts with an unsatisfactory account of the relation of Alaska to the Yukon territory, followed by a historical summary, explaining the acquisitions made by Russia, the United States, and Britain in the extreme Northwest. The unofficial conquests of the fur-traders had to be ratified by the governments whose flags they carried into the primeval forests and rivers bordering the Arctic. In 1867 the United States bought Alaska. In 1883 Schwatka, an American cavalry officer, descended the Yukon from its source to the sea. It became necessary to locate the international boundary line. Hence the expedition under Ogilvie in 1887. He crossed the coast range at the head of the Lynn Canal, by way of the Dyea pass, and while preparing for his survey he investigated another entrance to the interior that he named the White pass. This became famous during the rush to the Klondyke, in 1898. Thus at the very outset of his work he did a notable service, for the White pass became the recognized southern gateway to the Yukon. Dropping more serious matters, the third chapter is devoted to a humorous story of a lost mine. This is told with the artlessness that is the highest art. His survey and the detailed methods involved are next described. The beginnings of trade on the Yukon make a chapter of half-forgotten history, and the description of the trading-posts awakens echoes of dim romance, known to those who have camped under the northern lights. McQuesten, Harper, Healy, Mayo, and Moore mean little to the boulevards of Paris or even the sidewalks of New York, but in the Northwest their names are reminiscent of the hardihood, energy, and unselfishness of the heroic pioneer. Then comes the first whisper of gold, the magic word that was to open this vast region to a horde of adventurers. That was another time when Ogilvie did a notable public service, for the early locating of claims was so carelessly and improperly done as to entail endless confusion, with possible bloodshed and certain litigation. The confidence of the frontier community in Ogilvie was so great that they asked him to straighten the tangle; and he did, to the satisfaction of all except the two or three bad men, who fumed, threatened, and left the district. Ogilvie had been made a Commissioner of Police before his first entry into the country, and thus was qualified to do such public service. The story is interspersed with intensely human, and humorous, glimpses of life in the Northern diggings.

When the Klondyke rush began in the autumn of 1898, it was to Ogilvie that the outside world owed

the first authoritative confirmation of the discovery of a great goldfield. He estimated that 60 claims in Bonanza creek and 40 in Eldorado would average not less than \$1000 per running foot. As each claim was 500 ft. long, this meant gold to the value of \$50,000,000. The handbook written by Ogilvie for the benefit of newcomers to the Klondyke was a great boon to the tenderfeet or *chechakos*, and proved useful to everybody interested in the new goldfield. It seemed Ogilvie's good fortune to be continually doing useful things and helping other people. And through it all not a suggestion of graft or loot was made, even by his enemies. He was a strong brave character, able to keep his head amid the orgy of gold-winning, capable of complete detachment amid temptations of the most vivid kind. Ogilvie was one of those civil servants on whom the greatness of the British empire has been built.

William Ogilvie is dead. The preface to the book is written by O. P. R. Ogilvie, a relative. Neither in the preface nor in a feeble appendix by a Dr. Alfred Thompson is any reference made to these facts. While the first person is used in the text, the chapter headings tell of "Mr. Ogilvie" doing this or that. A bigger blunder—and one that is inexcusable in a book dealing with a region so little known—is the lack of any map. For these errors the publishers, not the author, is responsible. This book is deeply interesting; it is an authentic record of a famous episode in mining; it would have been a great pity if it had not been written; it ought to be read by all who are interested in the Northwest, and by others.

T.A.R.

The Investor's Guide. Cloth, octavo, 160 pages. London: *The Financial Times*. Price 1s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is a really useful manual for investors, not so much on account of the descriptions of current Stock Exchange practice, but by reason of the miscellaneous hints, incorporated in a chapter by themselves. "No mining share can be regarded as an investment." "Nearly all mines—even on the Rand—have their lean and fat years." "Metalliferous mines are generally richest near the surface." "Beware of such titles Extended, North, South, etc.; most millionaires have plenty of poor relations." "If you read a report signed by an M.I.M.M. it is fair to assume that it is by a man of responsible mining experience with a reputation to lose." These are excellent examples of the words of advice contained in the chapter. *The Financial Times* has won a deserved reputation for independence and detachment, and its advice in the editorial columns and in the 'Answers to Correspondents' is not tainted by the self-interest of the editorial staff. Of the 15,000 answers published yearly, not one is given without the thought for the ultimate benefit of the inquirer. The book describes the working of the Stock Exchange, prices and quotations, special settlements, options, underwriting, etc.; helps to read a prospectus and balance-sheet; classifies investments and speculations, and discusses a hundred and one details in connection with the careful placing of money. A full appreciation of the practice of the Stock Exchange and the Money Market is not possible, of course, without an apprenticeship to the trade, but between this complete knowledge on the one hand and crass ignorance on the other there is a wide interval, where the services of an honest guide such as this book are of immense value.

E.W.

COMPANY REPORTS

Huelva Copper & Sulphur Mines.—This company was formed in 1903 to acquire from a company registered seven years before, the Monte Romero and other copper properties at Cueva de la Mora, in the province of Huelva, Spain. The shares are held largely in France. Up to the present time the policy, usual in that district has been followed, of selling the pyrite for shipment abroad on its copper and sulphur content. The financial results have not so far been satisfactory, and some rearrangements of capital have been made. Two years ago, Henry F. Collins was appointed manager, and a new scheme of metallurgical treatment has been elaborated, namely, to smelt a portion of the ore on the spot. The plant is in course of erection and should be ready to start in February. The only other smelter in the Huelva district is at the Rio Tinto. The report for the year ended June 30 shows that 13,542 tons of cupreous pyrite, 1051 tons complex ore, and 348 tons of copper precipitate averaging 66% metal, were shipped, together with other products of less importance. The income was £46,111, and the balance of profit was £3828, which was carried forward. The output of ore was 15,409 tons from the Monte Romero, 13,350 tons from the Angelita, and 20,112 tons from the La Corta, making a total of 48,871 tons. The new scheme of development and equipment has been actively pushed, and until everything is ready the output is not being expanded beyond what is necessary to fill current contracts. It will not be before the beginning of 1915 that the output will be on the contemplated increased scale. Mr. Collins gives details of the development work and of the new plant. During the year, 61,180 tons of ore was added to the cementation heaps, averaging 0.69% copper. The heaps contain 239,249 tons, averaging 0.758% copper. The company is to be congratulated on having been free from the strikes so prevalent in the south of Spain recently. A co-operative stores society has been started, also a savings bank, and a sick benefit society, all of which appear to be welcome among the employees. Special attention is being paid to health conditions in the mines and on the surface. The smelting plant was purchased from a property in the same district. This plant had been erected but practically never used. The cost to the company was therefore much less than if a new plant had been provided.

Mount Elliott.—This company was formed in London in 1907 to acquire the Mount Elliott copper mine situated 70 miles south of Cloncurry, Northern Queensland. The first arrangements for smelting were not satisfactory, and on the subsequent appointment of W. H. Corbould as engineer, extensive rearrangements were made. The remodelled plant was started in 1910, and the first dividend was paid two years ago. A year or more ago it was found that the rich ore does not continue below the 4th level. On the 5th level and in a winze below, the ore occurs as rich patches scattered over a wide ore-channel. In order to provide for the future, a proposition was made to amalgamate with the Hampden Cloncurry, which had a mine and not a commensurate smelting plant, but terms could not be arranged. The policy of testing and acquiring other properties in the Cloncurry region was thereupon adopted. The Consols mine had been purchased and developed. Operations, however, were impeded by a fire in the shaft in February last, and a new main shaft is now being sunk. The Selwyn is giving fairly good results; here the ore appears to occur in separate lenses not easy to find. Eight other properties are being tested, with various

results. Railway communication will be necessary before any of them could be extensively developed. The report for the year ended June 30 shows that, owing to the fire at the Consols mine, the smelting plant was in commission for only 7½ months, as the furnaces could not conveniently be made to run on Mount Elliott ore alone. After the close of the year, operations were resumed, but a creep in the Mount Elliott workings caused trouble. During the 7½ months, 41,633 tons of ore was treated for a return of 4673 tons of blister copper, containing 4631 tons of copper, 8757 oz. gold, and 7285 oz. silver. The income from the sale of products was £414,662, and the profit was £141,811. Adding the latter to the balance brought forward from the previous year, £88,486, made a disposable balance of £230,297, out of which £202,837 was paid as dividend, being at the rate of 27s. 6d. per £5 share. Mr. Corbould estimates the reserve at the Mount Elliott at 35,000 tons and the probable ore at 15,000 tons, all averaging 10 to 12% copper, and at the Consols 8000 tons and 22,000 tons respectively, also of 10 to 12% grade. At the Selwyn 1500 tons of same tenour has been proved. Of low-grade ore, 350,000 tons, averaging 3%, is estimated to be in the Mount Elliott and Consols.

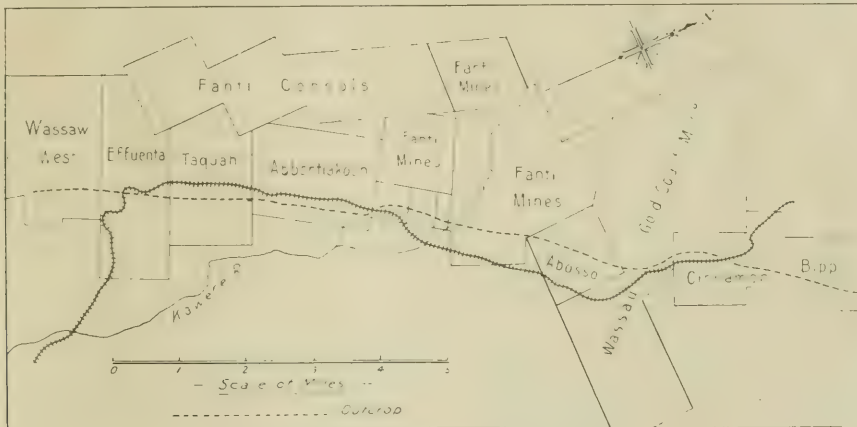
Chillagoe.—This company was formed in Melbourne in 1898 for the purpose of working copper and lead mines in Northern Queensland, and to construct a railway to them from Mareeba. It also has multifarious interests connected with the smelting of custom ores mined by subsidiary companies and by other producers. The capital has been rearranged and increased several times, and no dividend has ever been paid on the shares. In February last the directors decided to reconstruct in order to raise additional capital for the development of the Mount Mulligan coal deposits, and the scheme involved the assessment of 3s. on each 10s. share. Litigation with regard to this reconstruction has supervened, and in the meantime the business is being carried on by the official liquidator of the old company. The report for the year ended March 31 last has just been issued. The capital consists of £587,500, divided into 1,175,000 shares of 10s. each, and there are £848,000 debentures. There is also an overdraft from the bankers of £69,472. In the Chillagoe district, the only mine that has been actively developed was the Muldiva, from which 3213 tons of ore, averaging 2.3% copper, 17% lead, and 8 oz. silver per ton, was sent to the smelter. The Einasleigh mine in the Etheridge district produced 27,439 tons, averaging 5.4% copper, 0.36 dwt. gold, and 1 oz. silver per ton. From the Union mine 150 tons of ore was produced, averaging 6 oz. gold, 12 oz. silver, and 20% copper. About 1089 tons of custom ore was bought in the Forsayth district in small parcels. At the smelting works these ores were treated, together with supplies on contract, 12,847 tons coming from the Mungana, a subsidiary company, and other small amounts from other mines. The total ore treated was 58,989 tons. Two furnaces were in use, one on copper and the other on lead, but their running was not continuous, owing to shortages of ore, delay in deliveries of coke, and unusually wet weather. The production was 2906 tons of lead bullion, containing 2841 tons of lead, 7991 oz. gold, and 179,094 oz. silver, and 2200 tons of blister copper, containing 2177 tons of copper, 1835 oz. gold, and 93,576 oz. silver. The loss was £10,098, but against this was a profit of £63,890 on the railway, so that the working profit was £53,792. Debenture interest absorbed £30,089, and interest on loans £3360; £28,509 was written off the value of shares held in other companies.

After the payment of administration expenses, there was an adverse balance of £16,512 on the year's transactions.

Taquah Mining & Exploration.—This company was originally formed in 1888 as the Taquah & Abosso Gold Mining Co. to acquire gold-mining properties in West Africa. In 1901 the company was divided, the Abosso mine being handed to a subsidiary, and the two mines run separately. The Abosso has paid dividends since 1905, but the only dividend paid by the Taquah was for the year 1908-9. The Taquah company has a large shareholding in the Abosso. For the purpose of pressing development, milling was suspended from July 1910 to July 1911. The control is now with the Oceana Consolidated, and J. W. Newbery is manager. A large amount of money was provided by the Oceana which has to be repaid out of profits. The report for the year ended June 30 last shows that 61,607 tons of ore was milled, yielding gold worth £179,591 by amalgamation and £32,751 by cyaniding sand, making a total of £179,591, or 58s. 3d. per ton milled. The plant for treating the slime is in course of erection. The cost was £112,630, and £22,662 was written off for depreciation of plant. In

and when the electric-power plant is installed, it is intended to work at full capacity by taking 10,000 tons from the Abosso and 5000 tons on tribute from the Cinnamon Bippro. The first delivery of ore from the latter mine is expected this month. By this arrangement it is hoped not only to make a custom profit, but by working at full capacity to reduce the cost. The ore reserve on June 30 was calculated at 266,401 tons, averaging 37s. 3d. over 55 inches, and the possible ore is given at 104,676 tons, the content of which cannot be estimated. It is difficult to give exact forecasts of the results of stoping, because the gold is distributed irregularly across the lode. At places the whole width may have to be worked, and at others it will be advantageous to mine only the narrower and richer portions on the foot-wall side. The lode has been recently cut on the 13th level and satisfactory assay-values have been obtained; it is too early however to give any estimate of the nature and extent of the ore-body at this level.

Cinnamon Bippro.—This company was formed in 1902 by the Consolidated Gold Fields of South Africa to acquire a gold-mining property at the northern end of the Tarkwa bank outcrop in West Africa. The



PROPERTIES AT TARKWA, WEST AFRICA.

addition £22,041 was written off shares and debentures held in the Ancobra Exploration & Dredging Co., and £7170 written off the shaft-sinking and exploration account. A dividend of £6357 was received from the Abosso company. The balance of profit £24,034 was carried forward. The ore reserve on June 30 was calculated at 198,502 tons averaging 60s. per ton. Difficulty has been experienced with the gas-power plant, so steam-power is being installed. The loan from the Oceana, standing at June 30, 1912, at £128,045, has been reduced during the year to £50,000, and this outstanding balance is to be repaid in quarterly instalments during the next 3 years.

Abosso Gold Mining.—As recorded in the preceding paragraph, this company is a subsidiary of the Taquah Mining & Exploration and has been paying dividends since 1905. During the year ended June 30 last, 104,400 tons of ore, averaging 40s. per ton, was treated, and gold worth £184,757 was recovered, being 35s. 3d. per ton milled. The slime is being stored for future treatment. A plant has been erected for the purpose and is on the point of starting. The new 50-stamp mill and grinding-pans were completed during the year. The capacity is 15,000 tons per month,

early developments were excellent, and by many people qualified to judge, the mine was held to be one of unusual promise. Before long, however, it was found that it was a case of impoverishment at depth. A large part of the ore on the 3rd level and all on the 4th level has proved to be of too low a grade to be profitable. The mine was allowed to fill with water a year ago. The report for the year ended June 30 last states that arrangements have been made for reopening the mine and extracting as much ore as is profitable. This is to be sent by aerial ropeway 2 miles long to the Abosso company's mill, at the rate of 200 tons per day. The ore reserve is calculated at 345,974 tons, averaging 8½ dwt. gold per ton. The issued capital of the company is £252,595, and £85,730 (part of a loan of £120,000) has been borrowed from the Gold Coast Amalgamated, the Gold Fields parent company operating in West Africa.

Camp Bird.—This company was floated in London in 1900 by F. W. Baker and John Hays Hammond to acquire from Thomas F. Walsh the Camp Bird gold mine in Ouray county, Colorado. After yielding handsome profits for 10 years, the lower levels showed signs of impoverishment, and other properties were

sought. The Santa Gertrudis silver mine at Pachuca, Mexico, was purchased and floated as a separate company, the Camp Bird retaining 1,113,096 shares. Later it was decided to extend the scope of the company and make it a sort of mining investment trust. In this way several items of business have been handled, one being the guaranteeing of interest on £250,000 debentures of the Messina copper company in consideration of an option on 125,000 shares in that company. The report for the year ended June 30 last shows that development has been confined to the ground round No. 3 shaft, where the results in depth have been better than expected and will keep the mine going longer than originally estimated. Only 25 of the 60 stamps have been working, and 30,012 tons of ore treated. The sale of bullion brought an income of £77,272 and of concentrate £60,790. Other small items brought the total revenue to £138,904 or £4. 12s. 6d. per ton milled. The working profit was £48,645 or £1. 12s. 5d. per ton. The average content of the ore was 19½ dwt. gold, 3.83 oz. silver, 1.42% lead, and 0.217% copper. Since the inception of the company, 732,221 tons of ore has yielded a revenue of £4,254,571 and dividends of £2,702,578. William J. Cox, the manager, estimated the reserve on August 31 at 31,000 tons, from which a profit of £66,800 may be expected. In addition to the profit made at the mine, the company received dividends of £157,224 from the Santa Gertrudis. Dividends absorbing £45,500 were paid on the 650,000 7% participating preference shares, and £110,005, being at the rate of 10%, on the ordinary shares. At the meeting of shareholders, A. M. Grenfell, the chairman, gave particulars of the Nicaragua properties, which were described in our issues of August 1910 and August 1913. Particulars of the work at the Santa Gertrudis are given in the next paragraph.

Santa Gertrudis.—This company was formed at the end of 1909 by the Camp Bird company to purchase the control of the Santa Gertrudis silver mine at Pachuca, Mexico. The capital is £1,500,000 in £1 shares of which 1,113,096 are held by the Camp Bird. The report for the year ended June 30 last shows that 263,554 tons of ore was sent to the mill where bullion containing 21,807 oz. gold and 4,243,932 oz. silver was extracted, being a recovery of 47s. 11d. per ton. The income was £631,718, the working cost £370,859, allowance for depreciation of plant £25,374, and the working profit £235,485. This profit is lower than anticipated, owing to the ore not coming up to expectations. The dividends absorbed £225,000, being at the rate of 15%. William J. Cox, the advisory engineer, and Hugh Rose, the manager, estimate the ore reserve at 778,000 tons and the probable ore at 269,000 tons, the profits to be made being £776,000 and £213,000 respectively. The 19th level has so far proved disappointing, and on the 20th level the vein as far as examined by cross-cut is no better. The plan now is to explore the remainder of the property by cross-cuts and to develop other veins, eleven of which

to the smelters for £19,943 gross, or £13,851 net after payment for freight and treatment; 10,313 tons was mined by the lessees, and sold for £47,325 gross or £33,661 net. The royalty accruing to the company from the tributors' ore was £11,103. At the low-grade plant, 104,111 tons of dump material and 25,999 tons of mine ore was treated yielding 15,707 oz. gold, of which 6891 oz. was recovered in concentrate, and 8816 oz. in bullion. The operating profit at the mill was £26,989, of which £3254 was credited to the mine for low-grade ore treated. The general expenses at the mine were £27,659, including £4755 for development, and £6703 administration expenses. London expenses absorbed £2150, settlement of the Portland company's claim £2062, settlement of the Moore Filter company's claim £859, income tax £717, and £1752 was allowed for depreciation. The net profit for the year was £17,777, which added to the balance brought forward made a total disposable amount of £29,680. Out of this, £25,000 has been distributed as dividend, being at the rate of 6d. per 2s. 6d. share. As usual the report contains a full statement of operations written by the consulting engineers and managers, Philip Argall & Sons. We published an article by Philip Argall on the present scheme of operations in our issue of November 1911.

Tyee Copper.—This company was formed in 1900 to acquire from Clermont Livingston the Tyee group of copper mines situated on the western side of Mt. Sicker, British Columbia. A smelter was erected at Ladysmith in 1902. Small dividends were paid from 1904 to 1907, but after that the mine became exhausted. Efforts to conduct custom work did not meet with success, and the smelter is now closed. Six months ago the Ptarmigan group was acquired and floated separately. When these mines are producing the smelter will be re-started. The control is now with the Siemens group. The report for the year ended April 30 shows that the capital is £180,000, and that £37,000 has been borrowed from bankers against security; besides which £16,000 has been raised on mortgage on the company's property. The company has a reserve fund and investments of £46,783.

Pigg's Peak Development.—This company was originally formed in 1889 to acquire an extensive tract of country in Swaziland in the neighbourhood of Pigg's Peak. Only a small part of the property has been prospected, and attention has been chiefly centred on the Peak gold mine, which has proved a tough proposition from both the mining and metallurgical point of view. Many managers have come and gone, and several metallurgical processes have been tried. There have been two reconstructions, the last in 1898, when L. Ehrlich & Co. assumed control, with E. T. McCarthy as consulting engineer. Additional capital was subscribed in 1905 and 1909, making the total £340,000, and in 1909 £45,000 debentures were created. No dividends have been paid, but the debentures have been reduced to £15,725 out of profits at the mine. During the year ended March 31, 32,330 tons of ore was raised and treated for a yield of bullion worth £48,132 and concentrate selling for £6843, making, with rents, a total income of £55,795. After allowing £8865 for depreciation, a net profit of £14,247 was made, which was carried forward. Of the ore, 26,612 tons came from the old mine, and 5718 tons from the new section adjoining. The assay-value of the former was 7.87 dwt. and of the latter 13.74 dwt. per ton. Development is being actively pushed below the 6th level. Charles Hunter, the manager, estimates the reserve at the old mine at 55,298 tons averaging 6.64 dwt. per ton, and at the new section 18,271 tons aver-

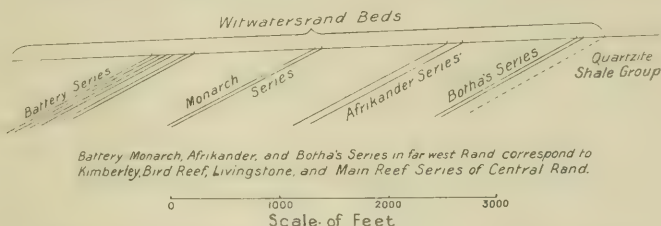
Stratton's Independence.—It is not necessary here to recapitulate the history of this famous gold mine at Cripple Creek, Colorado. Suffice it to say that, of late years, operations have been confined to re-treating the dump by the method devised by Philip Argall and to the removal of any remaining ore of high grade, by the company and by tributors. The report for the year ending June 30 last shows that the likelihood of finding rich ore is decreasing and that the profits will not be maintained. During the period under review, 12,500 tons of ore was mined by the company, and sold

aging 12.9 dwt. Prospecting at Ruby Creek has not so far disclosed gold in sufficiently large quantity to warrant development. The Mhlattan property is being prospected by three shafts, and though the results so far have given low assays and narrow veins the prospects are hopeful and the work is to be continued. The company also owns the Eagle's Nest property near Barberton which it bought some years ago. A mill had already been erected, but it has never been started, and the property is held for future development.

Luipaard's Vlei Estate & Gold Mining.—This company was formed in 1888 by the Consolidated Gold Fields of South Africa to acquire a property at Krugersdorp in the far west Rand. It was reconstructed in 1896. Milling was started in 1898, but was suspended in the following year until 1906. Small dividends were paid in 1908 and 1909. In the latter year the property of the Windsor mine was absorbed. In 1912 a change in the control was effected, L. Ehrlich & Co. undertaking the reorganization of the board and the management. C. B. Saner was appointed general manager. The report now issued covers the year ended June 30 last. During this period, 243,312 tons was raised and 11,700 tons taken from the dumps; after the rejection of 22% at the sorting stations, 196,780 tons averaging 5.3 dwt. was sent to the 60-stamp mill.

The Main Reef Series used to be called Botha's Reef, and still often is. There are two separate beds called the Main and South Reefs respectively. The accompanying illustration gives a cross-section through the property showing the various beds of banket. The Battery Reef is wide, and the distribution of the gold is variable and patchy. It is also much faulted. Such stoping as has been done recently is in the nature of prospecting.

Simmer & Jack Proprietary Mines.—This company was formed in 1887 to acquire property in the eastern part of the Central Rand. The mine has been producing regularly since 1888 and is the most important asset of the Consolidated Gold Fields group. The metallurgical equipment contains 320 stamps and 7 tube-mills. During the year ended June 30, 938,103 tons of ore was raised, and after the rejection of 23% waste, 912,200 tons was sent to the mill. The yield by amalgamation was 116,171 oz., and by cyaniding 114,473, a total of 230,644 oz., worth £971,096, being a recovery of 5.05 dwt. or 21s. 3d. per ton. The working profit was £469,854 or 10s. 3d. per ton. A further income of £38,075 was received from rents, dividends, etc., £41,089 was paid as profits tax, and £19,053 was placed to reserve for additions and renewals. The shareholders received £450,000 as dividend, being at the rate of 15%. The ore reserve on



SECTION ACROSS THE WITWATERSRAND AT LUIPAARD'S VLEI.

The gold recovered at the stamps was 21,699 oz., and below the 3 tube-mills 8815 oz. The cyanide plant extracted 18,696 oz., making the total yield 49,210 oz., worth £206,501, being 5 dwt. or 21s. per ton milled. The working cost including development-redemption was £180,594 or 18s. 4d. per ton milled, leaving a working profit of £25,997 or 2s. 8d. per ton. Also, an income of £10,399 was earned by the estate. After paying £2458 as London expenses, and £5587 as debenture interest, the balance of profit was £29,949, out of which £14,034 has been written off for depreciation of plant. As compared with the previous year the amount of ore milled was 3000 tons less, but the yield was £26,000 greater, owing to the grade of the ore being $\frac{3}{8}$ dwt. better. At the same time the cost per ton has increased by 1s. 3d. per ton owing largely to higher wages and expenses in connection with housing and contributions to insurance and compensation funds. The ore reserve stands at 581,795 milling tons, averaging 5.5 dwt. per ton, together with 91,819 milling tons partly developed estimated to average 4.7 dwt. per ton. These figures show an increase on the previous years, and owing to the encouraging outlook, the directors have decided to increase the monthly capacity from 16,500 to 21,500 tons by the addition of 2 more tube-mills. The property is worked in three sections, two of which are on the Main Reef Series, being the Luipaard's Vlei and Windsor mines, and the third on the Battery Reef to the south. The output comes almost entirely from the first two. It may be noted that, in the far west Rand, what is now called

June 30 was estimated at 2,524,000 tons averaging 5.0 dwt. per ton, and the partly developed ore at 406,004 tons averaging 4.7 dwt. per ton. The southwestern part of the property is receiving special attention at present. It will be developed from No. 2 deep-level auxiliary incline shaft, which is being continued to the southern boundary. The South Reef and Main Reef have been intersected in the 32nd cross-cut, and the 33rd cross-cut will be completed shortly. According to calculations based on claim-area, the life of the mine is estimated at 11 years. The sand-filling plant is described in our *Précis of Technology* in this issue. C. D. Leslie is consulting engineer and O. P. Powell manager.

Sub-Nigel.—This company was formed under Transvaal laws in 1895 to acquire property in the Heidelberg district of the Transvaal, containing banket deposits similar to those on the Rand. The geological authorities show that the Heidelberg deposits are continuations of the Witwatersrand series. The control of the company is with the Consolidated Gold Fields. After several reorganizations, the property of the Nigel Deep, belonging to the same group, was absorbed, together with a mill containing 30 stamps, 1 tube-mill, and cyanide plant. The report now issued covers the year ended June 30 last. During this time, 88,581 tons of ore was mined, and after the rejection of 36% waste, 56,172 tons was sent to the mill. The average number of stamps running was 25. The yield of gold was 26,313 oz., worth £110,306, being a recovery of 9.37 dwt. or 39s. 2d. per ton milled. The working

cost was £83,477 or 29s. 3d. per ton milled, leaving a working profit of £26,947 or 9s. 7d. per ton milled. Interest on loans, to the extent of £130,500, brought an income of £5208, and after the payment of taxes, the balance of profit was £33,436. Out of this, £32,369 was distributed as dividends, being at the rate of 7½%. This is the first dividend paid by the company. The ore reserve on June 30 last was calculated at 132,500 tons averaging 7·8 dwt., and the partly developed ore at 39,500 tons averaging 8·1 dwt. The ground is much broken by faults and dikes, and the reserve is difficult to estimate. The work subsequent to the close of the financial year has resulted in a fall in the profits, which is explained by the shortness of native labour and the consequent necessity of using more machine drills. The latter method of work involves the mining of a greater proportion of waste. The shaft sunk at the west end of the property cut the deposit at 1745 ft. on the incline, with disappointing results, as the 'reef' is only 6 or 7 inches wide and averages only 4 dwt. as far as sampled. In other parts of the property the development has been more satisfactory, as over 3894 ft. sampled, the 'reef' averaged 9 in. thick and 31·4 dwt. gold per ton in content.

Gaika Gold.—This company was formed in 1902 to acquire the Gaika mine from the Chicago-Gaika Development company. The mine adjoins the Globe & Phoenix to the south, and is situated in the central part of Southern Rhodesia. The vendor company was originally formed to take over from Willoughby's Consolidated and the Rhodesia Exploration & Development companies a number of claims in the Sebakwe district of Rhodesia. For some years the control was with the Rhodesia Exploration & Development company, but was transferred to the Gold Fields Rhodesian Development company last year. Milling commenced in 1905, the equipment including stamps, chilean mill, and cyanide plant. Dividends of 5% were paid in 1911 and 1912. Two years ago the adjoining Robin Hood claims were bought, and new capital was subscribed for metallurgical and electrical plant. The issued capital is £273,495. The report now issued, covering the year ended June 30 last, shows that 33,549 tons of ore was raised and treated, for a yield of 14,023 oz. gold, worth £59,507. The working cost was £47,908. The London expenditure was £1398, and £5978 was allowed for depreciation of plant, and £3336 transferred to development-redemption account. The developments at the Robin Hood are reported to be satisfactory. The total ore reserves are estimated at 71,893 tons averaging 14·4 dwt. per ton, as compared with 57,755 tons averaging 15 dwt. per ton the year before. In May 1912 the new slime-plant was started, but owing to the antimonial tailing not having been sufficiently weathered, the extraction was not good.

Falcon Mines.—This company was formed in 1910 by the Rhodesia Consolidated to acquire the Falcon group of gold-copper mines, situated 60 miles west of Gwelo, Rhodesia. Shortly afterward, the control passed to the Gold Fields Rhodesian Development company. H. A. Piper and A. J. Fraser are the engineers. Much has been heard recently about the valuation of the reserve, and we have devoted space to the subject. The report for the year ended June 30 shows that 3208 ft. of development work was done, and the 4th and 5th levels fully explored and opened. On the 6th level the orebody has been exposed by four cross-cuts. The incline shaft is down to this level, and the new vertical shaft, calculated to cut the deposit at 900 ft., is down to 704 ft. The following table gives

the length and width of the orebody at the various levels, together with the average assays. The length on the 6th level is not fully proved:

Level.	Length. ft.	Width. ft.	Gold. dwt.	Copper. %
No. 1	532	31	5·3	1·12
" 2	406	10	3·5	2·23
" 3	878	18	3·8	2·50
" 4	820	34	5·6	3·94
" 5	650	38	6·1	3·17
" 6	577	42	7·0	3·20

The ore reserve on June 30 was 817,011 tons averaging 5·7 dwt. gold and 2·62% copper, as compared with 629,000 tons averaging 5·45 dwt. gold and 2·44% copper the year before. Of the total ore, 638,389 tons is sulphide averaging 5·57 dwt. gold and 3·15% copper, and 178,622 tons is oxidized averaging 6·4 dwt. gold and 0·71% copper. The issued capital of the company is £400,000, and there are £250,000 debentures on which 5s. in the pound has been called-up. A concentration and smelting plant is in course of erection, and should be ready to start next June.

Cam & Motor.—This company belongs to the London & Rhodesian Mining & Land group, which is controlled by Julius and Samuel Weil. It was formed in 1910 to acquire gold mines and claims at Gatooma, in the Hartley district of Rhodesia. The Air, Good Shepherd, and other claims were purchased subsequently. Work so far has consisted chiefly of development at the Motor section of the property and the erection of treatment plant. In our issue of August last, Gordon F. Dickson described this plant. It is hoped that the plant will be erected and ready for work by the end of this year. The report for the year ended June 30 shows that development was continued until the end of December 1912, and that afterward operations were confined to preparing for stopping. To provide further working capital, 25,000 shares of £1 each were issued at 35s., and since June 30 the remaining 25,000 shares have been sold at 27s. 6d. each. The total nominal capital now stands at £517,500. The ore reserve at the Motor mine down to the 6th level is estimated by John McDermott, the manager, at 913,612 tons, averaging 44s. 6d. per ton. No sinking has been done below the 6th level. As already recorded in our columns, an option has been granted to the Giant Mines of Rhodesia, a company of the same group, on the Cam, Good Shepherd, and Petrol sections of the property. The reserve at the Cam is estimated at 92,628 tons, averaging 46s. 6d. per ton, and at the Good Shepherd 10,000 tons, averaging 42s. 5d. per ton.

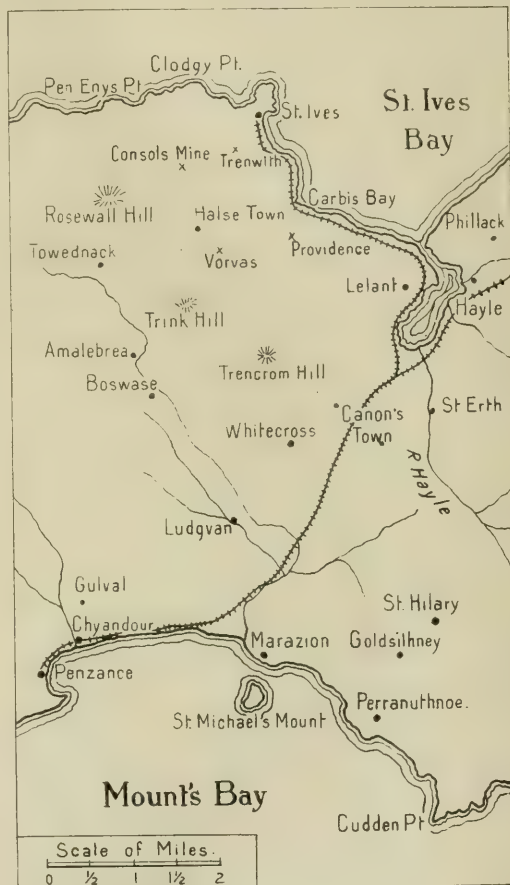
Naraguta (Nigeria) Tin Mines.—This company was formed at the beginning of 1910 to acquire from the Champion Gold Reefs of Africa a tract of alluvial tin land at Naraguta. The purchase price was £56,500 in cash and £98,500 in shares. The capital of the company is £175,000, of which £98,500 represents the above-named vendor consideration. No shares were offered publicly. The company has also acquired the Karama areas in the Ninkada district, and the Sho areas near Zungeru. Frank N. Best is chairman, C. G. Lush consulting engineer, and Frank O'D. Bourke manager. During the year ended March 31, 519 tons of tin concentrate was recovered by hydraulicking and calabashing, as compared with 560 tons the year before, the fall being due entirely to shortness of labour. The income from the sale of this was £62,587, from which is deducted £9912 for native wages, £15,403 for administration, freight, expenses, etc., £2635 as London expenses, £1690 for income tax, and £2141 for depreciation. There was also allocated £11,244

to the mine-development and new property account, and £9352 to expenditure on new water-supply and pipe-line. The shareholders received £8750, the dividend being at the rate of 5%. The completion of the new water-supply has been delayed by the failure of transport arrangements on the Government railway, and all the pipes are even now not delivered. It is hoped, however, to have everything ready for the next wet season. The output during the first 5 months of the company's present financial year is 434 tons, and during the remaining 6 months it is expected that a further 500 tons will be recovered. Transport facilities will be improved shortly by the extension of the railway from Rahamma to Bukeru, passing through Naraguta. The projected railway from the coast at Bonny to Zaria is expected to pass through the Karama properties. Mr. Bourke in his report mentions that efforts are being made to reclaim some of the cassiterite lost in the sluicing operations.

British Radium Corporation.—This company was formed in 1908 to acquire from the St. Ives Consolidated Mines the lease of the Trenwith property at St. Ives, Cornwall, where the dumps and the mine-workings contain pitchblende. The control is with the Schiff group, and Sir William Ramsay is the consulting chemist in connection with the extraction of radium from the pitchblende. Works for the extraction of the radium were established at Limehouse, in the east end of London. The issued capital of the company is £31,001 in shares of 5s. each, and there are £35,000 participating bonds. The shares were allotted as to £30,000 to the St. Ives company as purchase price and as to £1000 for cash subscribed. The bonds were issued to the St. Ives company at par in consideration of the subscription of working capital. The report now issued covers the year ended September 30 last. During this time the sales of radium compounds brought an income of £12,159. The expenses at the mine and works were £6377, office expenses were £1020, interest on bonds £2117, and amounts written off for depreciation and development account £1255. The balance of profit, £1270, was carried forward. The demand for radium compounds was small until June, when the pronouncements of English and German medical men suddenly caused a revival. The whole of the reserve stock was sold forthwith, and orders have been since received for further quantities. The demand is so great as to justify the extension of the treatment plant, and a new works is being erected at Elmers End, in Kent. The reserve of pitchblende contained in the ore at surface is estimated to contain 44,940 lb. uranium oxide, and the amount of radium bromide extractable from this is figured at 10,030 milligrammes. The dump and fines on the surface are expected to yield further substantial supplies by hand-picking and concentration. The mine is being thoroughly prospected, and at various points pitchblende has been found that is worth mining. The forward orders for radium bromide amount in value to £35,000.

British Broken Hill.—This company was formed in 1887 to acquire Blocks 15 and 16 from the Broken Hill Proprietary. The purchase consideration was £675,000 in cash and £400,000 in shares. The capital was £1,200,000 in shares of £5 each. In 1890 additional capital was raised by the issue of 60,000 privileged shares at £2 each, ranking equally with the £5 for dividends. In 1895 the capital was reduced to £264,000 by cancelling £4 on each £5 share and 32s. on each £2 share. In July 1912, 60,000 new shares were issued at 50s. each in order to provide funds for developing the newly discovered orebody. The mine

has been one of the least successful at Broken Hill and the total dividends have been only about 150% on the reduced capital, or 30% on the original capital. On two occasions operations have been suspended during periods of low prices for lead and silver. Work was resumed in 1910. An Elmore plant for treating the zinc tailing was built, but it was abandoned in March of this year, and the tailing was then sent to the Zinc Corporation for treatment. In the meantime



FROM ST. IVES TO PENZANCE.

the erection of a Minerals Separation plant was commenced, and it should be completed by the end of the current year. At the same time additions and alterations were made in the lead concentrator. During the half-year ended June 30 covered by the report now issued operations have been impeded, but only to a small extent, by the reorganization of the concentration methods and by the railway strike. During this time, 95,662 tons of ore was raised, as compared with 103,150 tons during the previous half-year. The lead concentration plant treated 95,090 tons averaging 13.4% lead, 12.1% zinc, and 7.5 oz. silver per ton. The yield of lead concentrate was 13,591 tons averaging 62.4% lead, 7.6% zinc, and 23.6 oz. silver. The Elmore plant, working 2½ months, treated 18,909 tons of zinc tailing averaging 13.8% zinc, 3.8% lead, and 3.7 oz. silver per ton, and produced 4981 tons of concentrate averaging 40.9% zinc, 11% lead, and 10.7 oz.

silver per ton; the recovery of the three metals being 77.8%, 75%, and 76.2% respectively. In addition 37,852 tons of zinc tailing was sent to the Zinc Corporation for treatment on joint account. Slime to the amount of 12,925 tons was produced and stored for delivery to the Junction North company. Development work on the new orebody has been actively pushed, and the body has been proved to extend downward to the 11th level. The general results of development are stated to be satisfactory, but no estimate of extent or content can yet be given. The accounts show an income of £166,371 from the sale of concentrate, tailing, and slime, and a profit of £50,968, which added to £34,954 brought forward made a disposable balance of £85,922, out of which £52,909 has been distributed as dividend. C. G. Klug is consulting engineer, and C. J. Emery manager.

Kalgurli Gold.—This company has been working a property at the northern end of the 'Golden Mile' at Kalgoorlie, West Australia, since 1897. Dividends were first paid in 1902, and the total distributed down to July 31 last has been £1,348,500, out of gold worth £3,348,943 won from 1,220,420 tons of ore. Two years ago signs of exhaustion were first noticed, and subsequent investigation showed that the ore disappeared as the lode passed into calc-schist. Development on the 1850-ft. level has been entirely disappointing, and a report made by Malcolm Maclaren in August of this year gives no encouragement for further sinking. The ore reserve now contains 250,000 tons, sufficient for two years working. The report for the year ended July 31 shows that 128,415 tons of ore was raised and treated, averaging 42s. 8d. per ton. The yield was worth £255,490, or 39s. 9d. per ton. The profit was £101,961, out of which £96,000 has been paid as dividend, being at the rate of 80%. The reports by the manager, R. S. Black, and by Malcolm Maclaren were issued immediately on their receipt in London early in October, in advance of the statement of accounts and directors' report. This action was welcome, considering the nature of Mr. Maclaren's views.

Yuanmi Gold Mines.—This company was formed in April 1911 to acquire, from the Lake View Consols, the Yuanmi mine, which is situated in the East Murchison district of West Australia. In November following, an amalgamation was effected with the Oroya Black Range company. The latter company had been formed in 1906 as a subsidiary of the Oroya-Brownhill company. The property worked by the Black Range company consisted of the Sandstone leases, also in East Murchison, 60 miles northeast of Yuanmi, and when the mine became disappointing in 1910 a half interest on the Yuanmi was purchased, the other half being taken by the Lake View. As recorded above, the Yuanmi was floated as a separate company, which subsequently absorbed the Oroya Black Range. H. C. Hoover is chairman, T. J. Hoover is managing director, Bewick, Moreing & Co. are general managers, and James Brothers are the consulting engineers. The report now issued covers the year ended June 30. At the Yuanmi mine, 64,530 tons of oxidized ore was treated by the all-sliming method for a yield of 25.869 oz. gold worth £109,904. The working cost including development was £56,990, to which must be added £17,526 spent on equipment chiefly in connection with plant for treating the sulphide ore. During the year, 5535 ft. of development was done. The reserve of oxidized ore was 23,488 tons assaying 34s. per ton, as compared with 57,922 tons averaging 41s. 5d. per ton the year before. The sulphide ore reserve was 47,903 tons averaging 41s. per ton, as compared

with 39,354 tons averaging 41s. 5d. The sulphide plant, consisting of dry crushers and roasting furnaces, has been erected and is about to be started. At the meeting of shareholders, Mr. Hoover announced regretfully that arsenic and antimony had put in appearance, which will add greatly to the difficulty of treatment. At the Oroya Black Range mine, 59,680 tons of ore was treated by amalgamation and by cyaniding sand and slime, for a yield of 25,249 oz. gold worth £107,212. The working cost was £79,402. The ore reserve was calculated at 45,377 tons averaging 33s. 6d. per ton, as compared with 50,697 tons averaging 36s. 8d. per ton the year before. The working profit at Yuanmi was £35,410 and at Oroya Black Range £27,822, or a total of £63,232, out of which £21,800 was written off for depreciation, £3697 paid as London expenses, and £4202 paid as taxes. The shareholders received £43,750, being at the rate* of 12½%.

Whim Well Copper Mines.—This company was formed in 1906 to acquire a copper deposit on Balla Balla creek, in the West Pilbara district of West Australia, not far from the port of Roeburne. Other adjacent properties were subsequently acquired, of which the Mons Cupri is the most important. This was floated as a subsidiary in 1910. The ore at the Whim Well occurs in a flat lode, and part of the oxidized ore is of sufficiently high grade to warrant picking and shipment to England. Diamond-drilling has proved the existence of sulphide ore below, of as great value as the oxidized ore above. Edgar Anderson is the chairman of the company, and H. R. Sleeman is the manager. The report now issued covers the year ended March 31 last. During this time, 17,123 tons of ore was mined, averaging 8.5% copper; of this, 3168 tons averaging 18% copper, and 4682 tons averaging 11½%, was shipped, yielding an income of £60,546, after deduction of smelters' charges. The cost of transport, etc., was £16,850, and the cost of mining was £21,329. Interest on debentures, advances on ore, etc., absorbed £2682, and London expenses £3300. The balance of 'profit' was £20,175, out of which £9761 was written off for depreciation of machinery, development, and expenses in connection with the Murex concentration plant. The balance was carried forward to provide additional funds for the alterations in the concentrators. The capital of the company is £225,000, and there are £22,500 debentures carrying interest at 7%. The capital was increased from £200,000 to £225,000 in January last to provide capital for reconstructing the concentrator. Dividends at the rate of 10, 12½, and 5% were paid for the years 1909-10, 1910-11, and 1911-12. In our issue of May last we gave particulars of the conditions necessitating alterations in the concentrators. It had been proved that the kaolin in the ore interfered with wet-crushing and screening, and that therefore a dry-crushing plant was being substituted. The remodelled plant was started in August. The ore reserve on March 31 consisted of 60,600 tons of dump material averaging 4½% copper, and 100,000 tons in the mine averaging 5% copper. The probable ore above the water-level is estimated at 1,000,000 tons averaging 5% copper.

At the meeting of shareholders held on November 27, the chairman stated that delay had occurred, and the Murex plant was not running at full capacity. The reason was that trouble had arisen in the manufacture of the magnetic material. The delay would not be for long, as arrangements had been made for the supply of the necessary magnetite. The Mons Cupri mine was reported to be developing excellently.

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